FINAL REPORT

TIME CRITICAL REMOVAL ACTION

LAKE LINDEN RECREATION AREA – AREA A

Prepared for

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EXECUTIVE SUMMARY

This Final Report summarizes the implementation of the Time Critical Removal Action (TCRA) within the Lake Linden Recreation Area (LLRA) Area A (the Site), generally located at 1000 Hiltunen Street in the village of Lake Linden, Houghton County, Michigan (**Figure 1.1**). The Site is located within the Torch Lake Great Lakes Area of Concern and the Torch Lake Superfund Site, Operable Unit (OU) 2. The TCRA was implemented by Honeywell within a portion of Area A (0.3 acre), under an Administrative Order on Consent (AOC; USEPA 2018) with the U.S. Environmental Protection Agency (USEPA).

Prior to implementation, a TCRA Removal Work Plan (RWP; Anchor QEA 2018) was prepared on behalf of Honeywell and serves as the basis of design for the TCRA. The objective of the TCRA was to address potential public health and ecological risks within the Site attributable to elevated concentrations of polychlorinated biphenyls (PCBs) and metals in sediment. The TCRA work described within this Final Report met this objective by dredging sediment from the Site and placing back clean materials, thereby minimizing the potential for direct human contact with impacted materials left in place.

Construction activities conducted as part of the TCRA implementation were completed between April 29, 2019, and July 1, 2019. The date of substantial completion for the Work was July 12, 2019, coinciding with the review and acceptance of the final construction contractor-provided as-built surveys. During the TCRA work, 3,694 safe site worker hours were performed by the construction contractor, subcontractors, and field construction oversight without a recordable incident.

Dredging activities were conducted from May 24, 2019, through June 11, 2019, for a total of 13 workdays. Dredging was conducted using land-based excavating equipment (Komatsu PC400 long-reach excavator) with a 1.75 cy environmental bucket. A series of temporary in-lake access roads were constructed using high-density polyethylene mats, timber crane mats, and imported gravel fill to facilitate access to the entire TCRA area. Dredge depths generally ranged from 2 to 4 feet, with limited areas shallower and deeper than that range. Approximately 1,578 in-

place cubic yards (cy) of contaminated sediment were removed from the TCRA area, based on survey comparison between pre- and post-dredge surfaces.

Calciment was added to the dredged sediment to stabilize the sediment prior to off-site transport and disposal. Following amendment with Calciment, the sediment was stored on the sediment processing pad for a minimum of 24 hours, and generally for at least 72 hours, to react with the Calciment and stabilize prior to off-site transport and disposal. Stabilized sediment was loaded into water-tight trucks and transported to K&W Landfill in Ontonagon, Michigan, for disposal. A total of 2,588 tons of stabilized sediment (and gravel from the sediment processing pad) was transported to K&W Landfill.

Following dredge verification, clean imported backfill materials were placed in the post-dredge footprint to minimize the potential for direct human or benthic contact with the impacted materials left in place by design. Additionally, clean cover materials were also placed on the sediment surface in a limited area along the east boundary of the TCRA area where dredging was not conducted (i.e., the Sand Cover Placement Only Area). Clean backfill and cover placement activities were conducted between June 12 and 22, 2019.

Clean backfill and cover placement activities were conducted between June 12 and 22, 2019. To achieve clean backfill and cover placement, land-based excavating equipment and temporary in-lake access roads were used, similar to dredging activities. Approximately 450 cubic yards of clean Michigan Department of Transportation (MDOT) 21AA gravel and 680 cubic yards of MDOT 2NS sand was placed within the boundary of the TCRA area.

Restoration of the upland remediation support area consisted of removal of the sediment processing pad, removal of the temporary access roads, and regrading, seeding, and mulching the ground surface to restore the upland remediation support area to its original condition.

As required by the AOC, a post-removal site control plan will be prepared separately and provided to USEPA under separate cover. The site control plan is expected to consist of regular post-construction surveys to verify that the installed backfill and cover remains in place.

1.0 INTRODUCTION

This Final Report summarizes the implementation of the Time Critical Removal Action (TCRA) within the Lake Linden Recreation Area (LLRA) Area A (the Site), generally located at 1000 Hiltunen Street in the village of Lake Linden, Houghton County, Michigan (**Figure 1.1**). The LLRA comprises a beach/park area and sediments in the northern part of Torch Lake, a portion of which is designated as Area A (**Figure 1.2**). The Site is located within the Torch Lake Great Lakes Area of Concern and the Torch Lake Superfund Site, Operable Unit (OU) 2. The TCRA was implemented by Honeywell within a portion of Area A (0.3 acre), under an Administrative Order on Consent (AOC; USEPA 2018) with the U.S. Environmental Protection Agency (USEPA).

1.1 PROJECT BACKGROUND

A TCRA Removal Work Plan (RWP; Anchor QEA 2018) was prepared on behalf of Honeywell and serves as the basis of design for the TCRA. The RWP presents the applicable site history and background information, a summary of the pre-design investigation, the TCRA basis of design, engineering drawings and technical specifications, and requirements for TCRA construction and monitoring. The RWP was submitted to USEPA in October 2018 and approved by USEPA on October 19, 2018. The objective of the TCRA was to address potential public health and ecological risks within the Site attributable to elevated concentrations of polychlorinated biphenyls (PCBs) and metals in sediment. The TCRA work described within this Final Report met this objective by removing sediment from the Site and placing back clean materials, thereby minimizing the potential for direct human contact with impacted materials left in place. In addition, the TCRA consists of an ongoing monitoring effort following construction completion, which is discussed further in Section 6.

The construction contractor selected to implement the TCRA was Sevenson Environmental Services (Sevenson), and the construction activities conducted as part of the TCRA implementation (the "Work") were completed between April 29, 2019, and July 1, 2019. The date of substantial completion for the Work was July 12, 2019, coinciding with the review and acceptance of the final construction contractor-provided as-built surveys.

1.2 PROJECT ORGANIZATION

The project team for the implementation phase of the project included the USEPA On-Scene Coordinator (OSC), the Project Respondent, the Project Respondent's Project Coordinator, and the selected construction contractor. The following were the roles and responsibilities of the project team members:

- **USEPA On-Scene Coordinator:** The USEPA OSC for this project was responsible for overseeing the Project Respondent and construction contractor's implementation of the Work and to ensure the implementation was conducted in accordance with the requirements of the AOC. The designated OSC for the project was Brian Kelly representing USEPA Region 5.
- **Project Respondent:** Honeywell was the Project Respondent. Chris French of Honeywell served as the Construction Manager during implementation.
- **Project Respondent's Project Coordinator:** The Project Respondent's Project Coordinator was readily available during implementation of the Work and responsible for administration of all actions required by the Project Respondent under the AOC. Paul LaRosa, PE, of Anchor QEA served as the Project Respondent's Project Coordinator. Additionally, Randy Brown, PE, of Anchor QEA observed the construction contractor's daily construction activities as Field Construction Oversight for the Project Respondent.
- **Construction Contractor:** Sevenson of Niagara Falls, New York, was the construction contractor selected to conduct the TCRA.

1.3 REPORT ORGANIZATION

This report is organized into eight sections, as summarized below, and multiple appendices:

- **Section 1:** Introduction—Presents an introduction to the Site and the project components
- **Section 2:** Permits and Approvals—Provides a summary of the permit equivalency process

- **Section 3:** Health and Safety Overview—Provides an overview of health and safety topics
- **Section 4:** Summary of TCRA Construction Activities—Documents the construction activities performed to complete the TCRA, including site preparation, dredging, backfill placement, and site restoration
- **Section 5:** Environmental and Construction Monitoring—Summarizes the environmental monitoring and sampling of various media performed during construction and documents generated during completion of the TCRA to track progress and verify completion
- **Section 6:** Post-Removal Site Control—Presents as-built survey data documenting site conditions upon completion of the TCRA construction and discusses ongoing monitoring
- **Section 7:** References—Lists the references used to prepare this report
- **Section 8:** Certification—Includes the certification for the content of this report
- **Section 9:** List of Acronyms and Abbreviations—Lists the acronyms and abbreviations used throughout this report

2.0 PERMITS AND APPROVALS

As outlined by the AOC (USEPA 2018; Section XII, Paragraph 38), typical environmental permits were not required for the TCRA construction because it was completed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

While CERCLA provides that "no federal, state, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite" (42 U.S. Code §9621e), this provision does not remove the requirement to equivalently meet or waive the permitting regulations that are Applicable or Relevant and Appropriate Requirements (ARARs). The approving agencies provided oversight, stipulated expectations, and set operational and construction limitations through team discussions and approval of the RWP (Anchor QEA 2018).

A comprehensive review of federal and state ARARs was included in the RWP. This TCRA consisted of a limited scope that was completed over the course of approximately 10 weeks. The scope was limited to the removal of impacted sediment and placement of clean backfill material that complies with applicable federal and state regulations and results in a net positive benefit by reducing exposure risks.

In addition to the applicable ARARs, the Work was conducted in accordance with all other applicable federal, state, and local permits. Sevenson obtained a Soil Erosion and Sedimentation Control permit from Houghton County prior to the start of work as well as the applicable permit from Portage Lake Water and Sewage Authority (PLWSA) of Houghton, Michigan, for construction water discharge and disposal facilities for final disposal of sediment removed from the Site.

An agreement between Honeywell and the Village of Lake Linden was also executed to obtain access to upland areas of the Site to support the TCRA work.

3.0 HEALTH AND SAFETY OVERVIEW

During the TCRA work, 3,694 safe site worker hours were performed by Sevenson, Sevenson's subcontractors, and Anchor QEA without a recordable incident.

Sevenson performed daily tailgate safety meetings prior to the start of each workday throughout project implementation. Each safety meeting was attended by Anchor QEA Field Construction Oversight, who provided additional health and safety observations when applicable. Health and safety observations were also included in Anchor QEA and Sevenson daily reports, and any initiatives relative to health and safety were tracked so that all issues were addressed. Weekly project team meetings were used to discuss outstanding health and safety issues, as applicable.

Responsibility for employee safety was retained by each contractor. The contractors had the following responsibilities relative to health and safety:

- Preparing a site-specific Health and Safety Plan (HASP) and safety procedures
- Conforming to Honeywell's Remediation & Evaluation Services Contractor Safety Workbook
- Ensuring each employee was properly trained in hazardous waste operations and emergency response and all other appropriate construction safety regulations
- Ensuring each employee was included in a medical surveillance program consisting of pre assignment and annual and exit physicals
- Providing daily "toolbox talk" safety instruction
- Conducting personal air sampling of employees to monitor exposure to airborne hazards as needed
- Providing personal protective equipment as needed
- Ensuring employee compliance with site and contractor safety rules
- Conducting an incident investigation and providing an incident report to site health and safety representatives in the event of an employee injury, property damage, or near miss incident

As the Field Construction Oversight, Anchor QEA had the following responsibilities relative to health and safety:

- Providing health and safety oversight of the on-site Construction Management Team personnel
- Reviewing contractor HASPs and safety procedures
- Conducting inspections of site activities to ensure contractor compliance with the HASP and applicable Occupational Safety and Health Administration regulations
- Receiving and reviewing contractor incident reports
- Reviewing employee training and medical surveillance records

4.0 SUMMARY OF TCRA CONSTRUCTION ACTIVITIES

The TCRA was implemented in accordance with the requirements and procedures outlined in the RWP (Anchor QEA 2018) and AOC (USEPA 2018), and TCRA implementation generally consisted of the following elements:

- Dredging the top 2 to 3 feet of nearshore sediment in the TCRA area impacted with lead, arsenic, and PCBs; over-dredging occurred in some portions of the TCRA area up to a depth of approximately 6 feet below the pre-construction mudline
- Placing a layer of gravel armor stone as a demarcation layer on the post-dredge footprint prior to clean material backfilling
- Subsequent backfilling in the removal areas with clean material to minimize the potential for direct human contact with impacted materials left in place
- Placing clean material over a small area contiguous with the removal area to minimize the potential for direct human contact with materials left in place (i.e., no dredging occurred in this area)
- Placing gravel armor stone at the outlet of the drainage channel, which discharges into Torch Lake in the TCRA area

4.1 MOBILIZATION, SITE ACCESS, AND SITE PREPARATION

Sevenson mobilized to the Site on April 23, 2019, to begin site preparation activities. Some heavy equipment (front-end loader, dozer) had been stored at a local facility over the winter and was delivered to the Site during the week of April 23, 2019, to begin construction activities. Temporary office trailers were also delivered to the Site during the week of April 23, 2019. **Figure 4.1** presents a site overview, including the upland staging area and in-water work area.

Due to seasonal weight restrictions for transporting heavy equipment over roads in the State of Michigan and Houghton County, commonly known as "Frost Laws," the PC400 long-reach excavator used for dredging and backfill placement could not be transported to the Site until the Frost Laws were lifted. Weight restrictions for all state trunkline highways were lifted on May 13, 2019, which enabled transport of the PC400 long-reach excavator from Sevenson's Niagara Falls, New York facility to

begin. Components for the PC400 long reach excavator arrived at the Site on May 22 and 23, 2019.

4.1.1 Site Security

Access to the upland support area was restricted via the use of temporary fencing. Orange construction fencing was utilized around the upland remediation support area (see **Figure 4.1**) and was installed on April 29, 2019. Temporary chain link fencing was utilized around the contractor support area, where the temporary office trailers and imported fill stockpiles were located, and the temporary chain link fencing was installed on May 3, 2019. Overnight security personnel were not employed during the Work.

Temporary Construction Fencing

In the portion of Torch Lake where the Work was conducted, site access was controlled via the use of a turbidity curtain (see Section 4.1.4.2 for details pertaining to turbidity curtain installation). Caution signs also were placed on the shoreline at the north and south ends of the turbidity curtain as a warning to boaters. No access by unauthorized personnel to any of the work areas was observed throughout the duration of the Work.

4.1.2 Utility Clearance

Prior to initiating intrusive construction activities, Sevenson used the State of Michigan's MISS DIG utility safety notification system to identify potential utilities in the construction areas.

In addition, a private utility locating service, Ground Penetrating Radar Systems from Milwaukee, Wisconsin, was employed to scan the upland remediation support area for the presence of utilities or other significant anomalies. The scan was performed on April 25, 2019. The total area scanned was approximately

30,000 square feet, with a maximum effective ground penetrating radar depth of approximately 4 feet.

The ground penetrating radar report is included as **Appendix A**. No utilities or significant anomalies were identified by the ground penetrating radar survey, and no utilities were encountered during construction activities.

4.1.3 Temporary Facilities

Prior to initiating construction activities, temporary facilities were established for use by site workers. Temporary facilities included three temporary office trailers (see **Figure 4.1**), a generator to power the trailers, portable toilets, a hand washing station, and appropriate personal protective equipment. Prior to installation of the trailers, snow removal was performed in the office trailer area on April 23, 2019.

4.1.4 Environmental Controls

Environmental controls were used during construction activities to manage the release of silts and turbidity into the environment. Environmental controls were used surrounding the upland remediation support area and within the lake as described in the following subsections.

4.1.4.1 Erosion and Sedimentation Control

In the upland remediation support area, erosion and sedimentation controls were installed around the perimeter of the sediment processing area and the temporary gravel access road to prevent the unfiltered runoff of stormwater from entering the lake (**Figure 4.1**). Erosion and sedimentation controls were installed by Sevenson in accordance with a Soil Erosion and Sedimentation Control permit that Sevenson obtained from Houghton County prior to mobilization to the Site.

Silt fencing was installed along the south and east sides of the upland remediation support area between the temporary gravel access road and the lake. Straw wattles were installed along the north and west sides of the upland remediation support area. Sevenson inspected the erosion and sedimentation controls daily during construction activities. A Houghton County representative also inspected the erosion and sedimentation controls on May 20, 2019.

4.1.4.2 Turbidity Control

Within the lake, Sevenson deployed a turbidity curtain around the TCRA area (see **Figure 4.1**). The turbidity curtain was installed on May 15, 2019, and remained in place throughout the duration of dredging and backfilling activities. The turbidity curtain was constructed of a pervious geotextile fabric designed to allow water to flow through the barrier while retaining fine sediment particles.

Turbidity Curtain

The turbidity curtain was constructed with variable skirt lengths, ranging from 1-foot depth in the near shore locations to 15-foot depth in the center (deepest) portion of the turbidity curtain deployment area. The turbidity curtain was affixed to a 10-inch diameter floatation collar, with a ballast chain attached to the bottom of the geotextile fabric. The turbidity curtain was installed approximately 30 to 60 feet to the east of the eastern boundary of the TCRA area and anchored in place using a concrete bin block at the north and south shoreline and five Danforth anchors placed at regular intervals along the length of the curtain. Sevenson inspected the turbidity curtain daily during construction activities.

Water quality monitoring was conducted outside of the turbidity curtain during dredging and backfill activities to monitor the effectiveness of the turbidity curtain. Water quality monitoring results are summarized in Section 5.2.2.

4.1.5 Sediment Processing Pad

To provide a working surface to contain dredged sediments and stabilize the dredged sediments prior to disposal, Sevenson constructed a sediment processing pad in the upland remediation support area. The sediment processing pad was approximately 150 feet by 75 feet in size and was constructed from May 7 to 16, 2019.

Installation of the sediment processing pad consisted of placement of the following layers:

Sediment Processing Pad

1. A fill sand layer of variable thickness, generally 3 to 6 inches, constructed as a leveling layer to direct water atop the pad toward a collection sump
2. A geotextile layer, placed as a cushioning layer underneath the linear low-density polyethylene (LLDPE) liner
3. A 40-mil LLDPE liner, placed as an impermeable barrier to contain and collect water generated during the sediment stabilization activities; the LLDPE liner was 89 feet by 160 feet in size and was delivered to the Site from the manufacturer as a single monolithic panel
4. A geotextile layer, placed as a cushioning layer atop the LLDPE liner
5. A gravel layer approximately 6 inches thick, constructed using MDOT 21AA gravel, that was placed to allow heavy equipment to operate atop the LLDPE liner without damaging the liner and to filter construction water as it drained toward the construction water collection sump
6. A perimeter wall constructed using 2-foot by 2-foot by 8-foot concrete bin blocks, to contain stabilized sediment stockpiled atop the sediment processing pad, and to prevent access by vehicles and personnel into the sediment processing pad

Along the east portion of the sediment processing pad, a temporary construction water processing system was installed, as described in Section 4.4.1.

4.1.6 Temporary Access Roads

To facilitate the transport of stabilized dredged materials from the sediment processing pad (see Section 4.1.6) and transport of imported fill materials to the

TCRA area, Sevenson constructed a temporary access road from the contractor support area to the sediment processing pad. The temporary access road was constructed using 6 to 8 inches of gravel that met the Michigan Department of Transportation (MDOT) specification for 21AA gravel. The MDOT 21AA gravel was underlain by a geotextile layer. The temporary access road was constructed in a loop so trucks would not have to back up during loading operations.

A dump truck loading area was constructed adjacent to the sediment processing pad using high density polyethylene (HDPE) mats. This alignment allowed dump trucks to pull up adjacent to the dewatering pad to be loaded with amended sediment so the trucks did not need to enter the exclusion zone and could always remain on the temporary access road.

Temporary Access Road

A temporary access road was also constructed between the sediment processing pad and the main in-lake access road (see Section 4.1.7) using MDOT 21AA gravel underlain by a geotextile layer. This included a 4-foot high offloading ramp constructed using MDOT 21AA gravel adjacent to the north wall of the sediment processing pad to facilitate the unloading of dredged sediments onto the pad.

4.1.7 In-Lake Access Roads

Because the majority of the TCRA area was in portions of the lake characterized by shallow water (less than 4 feet water depth), dredging and backfill operations were completed using conventional land based earthmoving equipment, consisting of a Komatsu PC400 long-reach excavator and two Hydrema off-road trucks. To access the TCRA area, Sevenson constructed a temporary road using interlocking HDPE mats. Upon completion, the HDPE mat road was approximately 180 to 200 feet long and 28 feet wide, and this road was used as a working platform for the land-based equipment.

HDPE Mat Access Road

The east end of the TCRA area was characterized by deeper water (8 to 12 feet water depth), and the effective working radius of the long-reach excavator was insufficient to reach the east end of the TCRA area from HDPE mat road. Therefore, to reach the east portion of the TCRA area, Sevenson constructed three "finger roads" perpendicular to the HDPE mat road at the north end, center, and south end of the HDPE mat road. The finger roads were constructed using timber crane mats. For the center and south finger roads, MDOT 21AA gravel was also placed under the timber crane mats to raise the elevation of the finger roads above the water surface elevation. Section 4.5 discusses the decommissioning of the temporary finger roads and the reuse of the gravel material used in road construction.

4.2 DREDGING

Dredging in TCRA Area

Dredging activities were conducted from May 24, 2019, through June 11, 2019, for a total of 13 workdays. Approximately 1,578 in-place cubic yards (cy) of contaminated sediment were removed from the TCRA area, based on survey comparison between pre- and post-dredge surfaces. Dredging was guided using real-time kinematic differential global positioning system (RTK-GPS) and Hypack's DREDGEPACK position tracking software system for accuracy in equipment location, bucket placement, and dredging operations. As discussed in Section 5.4, dredge verification was conducted via survey comparison.

Dredge depths generally ranged from 2 to 4 feet, with limited areas deeper than that range. The deeper removal depths were located in the vicinity of the existing channel outfall area, as designed, and near the top of the slope above the east end of the TCRA area. The pre-construction survey conducted prior to the start of dredging showed an existing sloping area, with slopes steeper than 3 feet horizontal to 1 foot vertical in some areas, with the toe of the slope located along the east edge of the TCRA area. Following dredging and dredge verification, it was observed that sloughing was likely occurring along this slope with material being deposited at the toe of slope. Due to this sloughing, although dredging operations were observed by the Field Construction Oversight along the east end of the TCRA area, dredging did not appear to meet the design grades in this limited area. The dredge design template was met over 95% of the TCRA area, as specified in the design; therefore, dredge depths less than the 2 feet required by the design were observed at approximately 5% of the TCRA area (non-contiguous) and comply with the performance requirements outlined in the RWP. The toe of slope area along the east TCRA boundary was not included in this computation based on communication and concurrence with USEPA dated June 11, 2019, regarding the sloughing issue, as further discussed in Section 5.5.

Dredging was conducted using land-based excavating equipment (Komatsu PC400 long-reach excavator) with a 1.75 cy environmental bucket. Where water depths were shallow (i.e., in the west half of the TCRA area), the dredging was conducted with the excavator positioned on the in-lake HDPE mat road. Within areas of the TCRA where deeper water depths would not allow excavator access, a series of access roads were constructed (as described in Section 4.1.7) to facilitate dredging to meet the design dredge limits and depths. Access roads were initially constructed using HDPE mats placed on the sediment surface. The excavator placed segments of the mat road as it advanced to the next dredging area, creating access as the Work progressed.

Most of the dredging was conducted in this manner. However, due to elevated water levels, sediment conditions, and the existing bathymetry at the Site at the time of construction, additional measures were required to access a limited portion along the east edge of the TCRA area. To reach the east edge of the TCRA area, MDOT 21AA gravel was placed underneath the center and south finger roads to a height sufficient to provide land-based excavator access for dredging. Following dredging operations and subsequent backfill placement operations (see Section 4.5) along the

east edge of the TCRA area, the surficial layer of the gravel fill was removed from the finger roads and disposed off-site at K&W Landfill in Ontonagon, Michigan. The remaining gravel used to construct the access roads was dispersed into the TCRA area, primarily in the south and west portions of the TCRA area, to assist in gravel demarcation layer placement (see Section 4.5).

Figure 4.2 presents the as-built range of dredge cut thickness across the TCRA area as determined by comparing the pre-construction survey to the post-dredge survey; additional information pertaining to survey verification techniques is included in Section 5.4.1. Post-dredge grades are provided in **Appendix B**.

4.3 DREDGED MATERIAL MANAGEMENT AND OFF-SITE TRANSPORT AND DISPOSAL

Dredged sediment was transferred to the sediment processing pad using Hydrema off-road trucks, where Calciment was added to the dredged sediment using a Caterpillar 330CL excavator. Calciment was added to the dredged sediment to stabilize the sediment prior to off-site transport and disposal.

The amount of Calciment added to the dredged sediment was dependent upon the portion of the TCRA area from which the sediment was removed, consistent with the RWP. A Calciment dose of minimum 5% by dry weight was added to sediment removed from Dredge Unit (DU) 1. For DU-2, DU-3, and DU-4, Calciment was added to the dredged sediments at a minimum Calciment dose of 2.5% by dry weight.

Dredged Material Management

Following amendment with Calciment, the sediment was stored on the sediment processing pad for a minimum of 24 hours, and generally for at least 72 hours, to react with the Calciment and stabilize prior to off-site transport and disposal. Any water that drained from the sediment during processing was directed to a sump

located in the east portion of the sediment processing pad, where the water was managed as described in Section 4.4.1.

Stabilized sediment was loaded into dump trucks provided by B&B Contracting of Calumet, Michigan, and Superior Sand & Gravel of Hancock, Michigan. The Caterpillar 330CL excavator positioned on the sediment processing pad loaded dump trucks positioned adjacent to and outside of the sediment processing pad. Polyethylene sheeting was placed underneath the dump trucks during loading to prevent contact between stabilized sediment and the temporary access road. After loading, the dump trucks transported the stabilized sediment to K&W Landfill in Ontonagon, Michigan, for disposal. A total of 2,588 tons of stabilized sediment (and gravel from the sediment processing pad) was transported to K&W Landfill. **Table 4.1** includes a transport and disposal summary, and non-hazardous waste manifests are included in **Appendix C**.

4.4 ADDITIONAL WASTE STREAMS

Waste streams beyond dredged sediment generated during the implementation of the TCRA include construction water, debris, and general construction waste. This section summarizes the following for each waste stream:

- Quantity and dates generated
- On-site waste management methods
- Analytical results required for waste disposal, where applicable
- Final disposal location

4.4.1 Construction Water

Construction water consisted of water generated from the dredging and dredged material dewatering process, precipitation collected on the contained sediment processing pad, and water generated during decontamination of equipment that had been in contact with dredged sediment. The sediment processing pad was constructed to drain toward a sump allowing for the collection of construction water. Construction water was collected from May 24 through June 13, 2019, and was

treated on site using a water treatment system that included the following components:

- 18,000-gallon capacity weir tank
- Bag filter unit
- 21,000-gallon capacity fractionation/storage tank

Construction Water Treatment System

After being collected and filtered, the treated water was stored in the fractionation tank prior to transport to the PLWSA of Houghton, Michigan, for final treatment. Sevenson collected a sample of the construction water for the parameters requested by the PLWSA (see Section 5.3.3). All sample results were within the required parameters for acceptance by the PLWSA except for pH, which was measured at 10.2. The elevated pH was likely the result of contact with the Calciment used as a stabilizing agent for the dredged sediments. With approval from the PLWSA, Sevenson added muriatic acid to the construction water within the fractionation tank until the pH was lowered to approximately 8.5.

Once the pH was in the required range, the filtered construction water was transported to the PLWSA by Superior Service Towing of Houghton, Michigan, using 1,500-gallon-capacity tanker trucks. Twelve truckloads of construction water with a cumulative volume of 17,250 gallons were transported to the PLWSA between June 11 and 13, 2019. Non-hazardous waste manifests for the transport of the construction water are included in **Appendix D**.

4.4.2 Debris

Debris was not encountered in the TCRA area during dredging activities. No removal, management, or disposal of debris was required prior to or during dredging.

4.4.3 Construction Waste

General construction waste was also collected throughout the implementation of the TCRA and included the geotextile and LLDPE liner from underneath the sediment processing pad, personal protective equipment, sediment and erosion controls, turbidity curtains, general rubbish, etc. Construction waste was temporarily stored on site in roll-off boxes and subsequently transported off site and disposed at K&W Landfill located in Ontonagon, Michigan, which is the same landfill where the stabilized sediment was disposed.

4.5 CLEAN BACKFILL AND COVER PLACEMENT

Following dredge verification, clean imported backfill materials were placed in the post-dredge footprint to minimize the potential for direct human or benthic contact with the impacted materials left in place by design. Additionally, clean cover materials were also placed on the sediment surface in a limited area along the east boundary of the TCRA area where dredging was not conducted (i.e., the Sand Cover Placement Only Area). Clean backfill and cover placement activities were conducted between June 12 and 22, 2019.

Clean material placement (both backfill and cover) consisted of the following:

- A target 6-inch (+/- 3 inches) gravel armor stone layer placed over the TCRA footprint (including the Sand Cover Placement Only Area) to act as a demarcation layer between native sediment left in-place and clean sand placement. As-built surveys indicate that the actual thickness of this layer was more than the targeted 6 inches in portions of the TCRA area due to field conditions (i.e., steep slopes).
- A target of 18 inches of sand was planned in the RWP for placement over DU-1 through DU-3 on top of the gravel armor stone layer to provide a buffer between the demarcation layer and potential swimmers. The gravel and sand backfill layers together were designed to achieve a total of at least 2 feet of material and return the TCRA area to pre-construction grades (except for a portion of DU-4 where the design required deeper dredging to accommodate additional drainage channel discharge capacity). However, the planned sand placement thickness was modified from the original design in the field based on site conditions observed during the Work. A targeted 2-foot (+/- 6 inches)

sand layer was also placed in the Sand Cover Placement Only Area, consistent with the design.

- A 2-foot (+/- 6 inches) sand layer was placed over a portion of DU-4 (i.e., where target dredge depths were 3 feet). Consistent with the design in the RWP, backfill placed in this portion of DU-4 did not return the area precisely to grade to provide additional storage capacity for waters exiting the stormwater drainage channel. In the portion of DU-4 directly downgradient of the stormwater drainage channel discharge (i.e., at the mouth of the channel), a 12-inch gravel layer was placed, with no overlying sand layer, to prevent potential future erosion due to the forces of water discharging from the channel.

Clean Backfill Placement

As noted earlier in this section and further discussed in Section 5.5, conditions observed during the Work resulted in a field modification to the design of the backfill. The steeper slopes first observed during dredging operations also posed a challenge for clean material placement. When the gravel armor stone was first placed in the sloped portion of the TCRA area, it was observed through survey verification that the gravel was not holding as intended on the dredged slopes and, in some cases, was mounding at the toe of the slope. The result of this mounding was areas where gravel was placed in excess of the design thickness and placement tolerance (i.e., greater than 6 inches plus 3 inches). **Figure 4.3** presents the as-built range of gravel placement thicknesses across the TCRA area (see Section 5.4 for additional information regarding material placement verification). Subsequent sand placement in this area (DU-1 through DU-3) was originally designed to be approximately 18 inches to return the area to pre-construction grades (assuming a 2-foot dredge cut).

However, given the observed challenges with gravel stability on the slopes and the resulting excess thickness of gravel placed in some areas, the design and

construction team recommended that the sand be placed using a thickness approach, rather than attempting to match pre-construction grades, as a practical means to meet the intent of the TCRA. Specifically, in the areas with significant mounding of gravel from over-placement, the construction contractor was required to place at least 6 inches of sand above the gravel to meet the objective of the TCRA of placing at least some sand over the entire TCRA footprint, but to not result in excess placement causing a major anomaly in post-construction bathymetry. Elsewhere in the TCRA where the placed gravel thickness was not in excess of the design, the construction contractor was required to place 18 inches of sand backfill. In the majority of DU-1 through DU-3, this essentially returned the area to pre-construction grade with the exception of areas where there was excess over-dredging or where the slopes sloughed, which alleviated the need for the construction contractor to attempt placement of a considerable thickness to match the pre-construction grade. This approach was approved by USEPA on June 18, 2019. **Figure 4.4** presents the as-built range of sand placement thicknesses across the TCRA area.

Ultimately, clean backfill operations in DU-1 through DU-3 were considered complete (as approved by USEPA on June 18, 2019) if the following held true:

- Gravel demarcation layer was placed to a minimum thickness of 6 inches as verified by survey data (see **Figure 4.3**); in limited areas where survey data indicated a gravel thickness of less than 6 inches, manual probing was conducted to verify presence of gravel at these locations.
- Sand layer was placed at a minimum thickness of 18 inches except for areas of excess gravel placement where a minimum of 6 inches of sand was required as verified through survey (see **Figure 4.4**).
- The total material placement (gravel plus sand) was equal to or greater than 2 feet (+/- 6 inches) as verified through survey, essentially returning most of the area to pre-construction grade as planned in the design.

The total material placement thicknesses (gravel plus sand) across the TCRA area for DU-1 through DU 4 where sand was required by the design is shown on **Figure 4.5**. The total material (gravel) placed directly downgradient of the stormwater drainage channel is shown on **Figure 4.6**.

Material placement activities were conducted with the same land-based equipment used for dredging operations following the appropriate decontamination procedures and using the RTK-GPS system for accuracy in equipment and material placement location. Mat access roads were used to provide equipment access into the TCRA area for material placement as was similarly executed to facilitate dredging operations. Also, as discussed in Section 4.2, gravel access roads were required and constructed to reach limited areas along the east edge of the TCRA area that could not be accessed due to sediment conditions and high water-levels experienced during construction. The gravel access roads were used to place gravel and subsequent sand in the far eastern reaches of the TCRA area. After backfill placement in the east portion of the TCRA area was complete, a surface layer of gravel from the access roads were removed from the lake for disposal, and the remaining gravel from the access roads was used as a source of gravel for placing the 6-inch gravel demarcation layer in surrounding areas in the west portion of the TCRA area. As discussed in Section 5.4.2, backfill verification was conducted via survey comparison.

4.5.1 Gravel

Approximately 450 cy of clean MDOT 21AA gravel was placed within the boundary of the TCRA area. Gravel was sourced from Superior Sand & Gravel in Hancock, Michigan. The results of chemical and physical testing on the material is provided in **Appendix E** and **Appendix F**, respectively. The approved gravel material met the requirements of the technical specifications and applicable federal and state regulations.

The gravel sample for the 2,500-ton increment collected on June 13, 2019, was only analyzed for volatile organic compounds (VOCs) instead of the full suite of analyses required by Table 3.1 of the specifications included as Appendix A to the RWP (Anchor QEA 2018). Since the source of this material was from the same quarry for the duration of the Work and the VOC results are similar to the five other samples (i.e., initial, 500-, 1,000-, 1,500-, and 2,000-ton samples), it is assumed the results from the other analyses (semivolatile organic compounds, Michigan ten metals, and PCBs) would have been similar and acceptable. Because re-collection of the 2,500-ton increment sample would have resulted in substantial downtime to complete the work, a field variance was issued to accept this interval sample with analysis of VOCs only.

4.5.2 Sand

Approximately 680 cy of MDOT 2NS washed sand was placed within the boundary of the TCRA area. Sand was sourced from Superior Sand & Gravel in Hancock, Michigan. The results of chemical and physical testing on the material is provided in **Appendix E** and **Appendix F**, respectively. The approved sand material met the requirements of the technical specifications and applicable federal and state regulations.

The sand sample for the 500-ton increment collected on June 13, 2019 was only analyzed for VOCs instead of the full suite of analyses required by Table 3.1 of the specifications included as Appendix A to the RWP (Anchor QEA 2018) and was not tested for geotechnical properties due to an error at the geotechnical laboratory. Since the source of this material was consistent and the VOC results are similar to the three other samples (i.e., initial, 1,000-, and 1,500-ton samples), it is assumed the results from the other analyses (semivolatile organic compounds, Michigan ten metals, and PCBs) and geotechnical testing would have been similar and acceptable. Because re-collection of the 500 ton increment sample would have resulted in substantial downtime to complete the work, a field variance was issued to accept this interval sample with analysis of VOCs only.

4.6 UPLAND RESTORATION

Restoration of the upland remediation support area consisted of removal of the sediment processing pad, removal of the temporary access roads, and regrading, seeding, and mulching the ground surface, as described in the following sections.

4.6.1 Sediment Processing Pad

The sediment processing pad was removed in stages between June 10 and 17, 2019. The concrete bin blocks around the perimeter of the sediment processing pad were pressure washed and returned to the company from which they were rented (Superior Sand & Gravel of Hancock, Michigan). The MDOT 21AA gravel used as the working surface of the sediment processing pad was incorporated into the stabilized sediment waste stream and loaded onto trucks for disposal at K&W Landfill, as described in Section 4.3. The geotextile layer above the LLDPE liner was incorporated into the MDOT 21AA gravel and disposed as well. The LLDPE liner

and the geotextile underneath the LLDPE liner were removed, folded into manageable sizes, and placed into roll-off boxes on site for eventual disposal at K&W Landfill.

The fill sand layer used as a leveling layer underneath the sediment processing pad was inspected once it was visible, and no signs of staining or other impacts were observed. The fill sand was pushed into stockpiles using a bulldozer and then transferred to the contractor support area. On June 19, 2019, a composite sample was collected from the fill sand stockpile from five discrete locations and submitted for laboratory analysis, as described in Section 5.3.5. All analytical results for the fill sand were below the Residential Direct Contact Cleanup Criteria promulgated under Part 201 of the Natural Resources and Environmental Protection Act, Act 451 of 1994, as amended (Michigan Department of Environment, Great Lakes, and Energy [EGLE], 2013, formerly known as the Michigan Department of Environmental Quality). As part of an agreement with the Village of Lake Linden, the fill sand stockpile was left at the contractor support area for future use by the Village.

4.6.2 Temporary Access Roads

Temporary access roads constructed in the upland remediation support area using MDOT 21AA gravel were removed using a Caterpillar 330CL excavator. The gravel offloading ramp located at the section of the temporary access road adjacent to the sediment processing pad was disposed at K&W Landfill along with the gravel from the sediment processing pad. The remaining gravel from the temporary access roads was stockpiled at the contractor support area. Two gravel stockpiles were placed at the contractor support area, one from gravel removed from the temporary access road located south of the sediment processing pad and the other from gravel removed from the temporary access road located north of the sediment processing pad.

On June 19, 2019, composite samples were collected from both gravel stockpiles from five discrete locations in each stockpile. The two composite samples were submitted for laboratory analysis as described in Section 5.3.5. All analytical results for the stockpiled MDOT 21AA gravel were below EGLE Part 201 Residential Direct Contact Cleanup Criteria. As part of an agreement with the Village of Lake Linden,

the MDOT 21AA gravel stockpiles were left at the contractor support area for future use by the Village.

4.6.3 Seeding and Mulching

Following removal of the sediment processing area and temporary access roads, in-kind restoration activities were performed for the ground surface at the upland remediation support area. First, a Harley Rake was used across the upland remediation support area to loosen the soil. Then a turf grass seed mix was applied to the ground surface, followed by fertilizer and mulch, to re-establish a grass cover. Seeding and mulching was performed by Halonen Landscaping of Atlantic Mine, Michigan, on June 27 and 28, 2019. To further re-establish grass cover, application of fertilizer was performed on July 30, 2019, and periodic applications of water will occur in August and September 2019.

Seeded and Mulched Ground Surface

5.0 ENVIRONMENTAL AND CONSTRUCTION MONITORING

This section describes procedures for environmental monitoring and protection, quality assurance and documentation, and protection of worker health and safety that were conducted during the Work.

5.1 WEEKLY REPORTS

To track and communicate construction progress, weekly construction meetings with the construction contractor and Honeywell were held to discuss progress and address any questions or issues that arose during construction. In conjunction with the weekly construction meeting, weekly reports were prepared by Honeywell to communicate site worker hours, safety performance, status of submittals and requests for information, work completed, planned upcoming work, and environmental monitoring results. Weekly reports prepared during construction are included in **Appendix G** and were submitted to the USEPA OSC during project implementation to communicate progress.

5.2 ENVIRONMENTAL MONITORING

Environmental monitoring was performed by the construction management team and the construction contractor throughout the duration of construction. The environmental monitoring included daily inspections of environmental controls and water quality monitoring during in-water work, as described in the following sections.

5.2.1 Daily Inspections of Environmental Controls

Inspections of the environmental controls consisted of daily inspections by Sevenson of the upland erosion and sedimentation controls and daily inspections of the turbidity curtain installed in the lake around the east perimeter of the TCRA area. No damages or defects were identified for either the erosion and sedimentation controls or the turbidity curtain throughout the duration of the Work.

5.2.2 Water Quality Monitoring

Water quality monitoring was conducted by the construction management team throughout the duration of in-water work. Monitoring was conducted for turbidity using a YSI 6820 sonde, which collects real-time measurements for turbidity measured in nephelometric turbidity units (NTU). Water quality monitoring was conducted at two locations; the first location was an early-warning station located 100 feet east of the turbidity curtain along the east end of the TCRA area, and the second location was a compliance station located 300 feet east of the turbidity curtain. Monitoring was conducted at two depths at each station: near the sediment surface at 20 feet below water surface, and one at mid water column at 10 feet below water surface. Water quality monitoring was conducted three times a day: once prior to the start of construction activities (which represented background conditions), once in late morning, and once in mid-afternoon.

Turbidity measurements were collected between May 24, 2019, and June 22, 2019, and results are summarized in **Table 5.1**. All turbidity measurements at the compliance location were below the stop work level of 25 NTU. At the early-warning location, all turbidity measurements were below the alert level of 25 NTU except for one measurement at 40 NTU recorded at 11:10 a.m. on June 7, 2019. Visible turbidity was also noted outside of the turbidity curtain at the same time this measurement was recorded. In response to the elevated turbidity measurement on June 7, 2019, an investigation was conducted. The likely source of the turbidity was the placement of MDOT 21AA gravel to construct the center finger road into the TCRA area as a platform to complete dredging along the east end of the TCRA area. No signs of damage, tears, or billowing of the curtain were observed during the inspection. Visible turbidity was present outside of the curtain along the entire length of the curtain. Potential causes of turbidity outside the curtain were concluded to be either turbidity escaping underneath the curtain or turbidity moving through the mesh of the permeable curtain. Although no further exceedances of the alert level occurred after the June 7, 2019 measurement, to address the potential for turbidity to escape underneath the curtain, the location of the curtain was adjusted on June 12, 2019, to relocate the turbidity curtain nearer to the boundary of the TCRA area; at the center point of the curtain, this relocation adjusted the position of the curtain by about 30 feet to the west.

5.2.3 Air Monitoring

Sevenson prepared a site-specific HASP prior to initiation of construction activities, designed to mitigate exposure of site workers to contaminants of concern. As part of Sevenson's HASP, air monitoring was conducted during dredging and sediment stabilization activities. Because there is no direct reading instrument for the determination of airborne concentrations of the primary contaminants of concern (arsenic, lead, and barium), real-time air monitoring was conducted for dust to develop a dust action level to workers from being exposed to metals over the permissible exposure limit. In addition to the real-time dust monitoring, Sevenson conducted personal airspace monitoring to obtain data specific to arsenic, lead, copper, and barium.

5.2.3.1 Dust Monitoring

In accordance with its HASP, Sevenson conducted air monitoring for dust for the duration of dredging and sediment stabilization activities to monitor potential worker exposure to respirable dust. Air monitoring was conducted at a fixed station near the shoreline, adjacent to the southwest corner of the TCRA area and approximately 50 feet north of the sediment processing pad (**Figure 4.1**).

Dust Monitoring Station

Dust monitoring was conducted from May 24, 2019, through June 14, 2019. Air monitoring results are included in **Appendix H**. Dust monitoring results remained below the action level specified by Sevenson's HASP (250 micrograms per cubic meter) throughout the duration of dredging and sediment stabilization activities, with a maximum recorded dust measurement of 86 micrograms per cubic meter.

5.2.3.2 Personal Airspace Monitoring

Personal airspace monitoring was conducted for two site laborers over the course of 3 days, from May 29 to 31, 2019. Air samples were collected using a personal sample pump with the intake placed near the worker's breathing zone, and submitted for

laboratory analysis of arsenic, barium, copper, and lead. All air monitoring results were non-detect for the analyzed parameters. Air monitoring results are included in **Appendix I**.

5.3 SAMPLING AND ANALYSIS

The following sections summarize sampling and analytical results that were compiled during completion of the work.

5.3.1 Surface Soils

In the upland remediation support area, surface soil samples were collected prior to construction of the sediment processing pad and again following disposal of all stabilized sediment and removal of the sediment processing pad, to verify that activities in the remediation support area did not adversely affect the ground surface. Five surface soil samples were collected from a depth of 0 to 4 inches from the location of the future sediment processing pad on May 2, 2019, and again on June 19, 2019, following removal of the sediment processing pad. All surface soil sample results were below applicable EGLE Part 201 Residential Direct Contact Cleanup Criteria. Sample locations are indicated in **Figure 4.1**, and laboratory reports are included in **Appendix J**.

5.3.2 Waste Characterization

Waste characterization samples for the TCRA area were collected in July 2018 and September 2018 as part of the pre-design investigation and are summarized in the TCRA RWP (Anchor QEA 2018). Based on the waste characterization sample results from the pre-design investigation, the receiving landfill (K&W Landfill in Ontonagon, Michigan) approved the acceptance of stabilized sediments from DU-2, DU-3, and DU-4. For DU-1, K&W Landfill requested the collection of an additional sample from the stabilized sediment after dredging and upland processing for analysis of lead via the toxicity characteristic leaching procedure (TCLP) prior to acceptance of the DU-1 sediment.

A sample of the stabilized sediment from DU-1 was collected on May 28, 2019, and submitted for laboratory analysis of TCLP-lead. The laboratory report is included in

Appendix K. Based on the analytical result, on June 5, 2019, K&W Landfill amended the waste profile for the project to include acceptance of stabilized sediment removed from DU-1.

5.3.3 Construction Water

As described in Section 4.4.1, construction water collected at the sediment processing pad was filtered on site using a weir tank and bag filtration unit and stored in a fractionation tank prior to transport to the PLWSA of Houghton, Michigan, for final treatment. In accordance with the agreement with the PLWSA, the filtered construction water was sampled for laboratory analysis prior to transport. Construction water analytical results are included in **Appendix L**.

5.3.4 Backfill Materials

As outlined by the RWP, chemical and physical testing was conducted for the imported sand backfill, sand cover, and gravel initially prior to bringing the materials to the Site and every 500 tons thereafter. Analytical testing was performed for VOCs (USEPA Method 8260C), semivolatile organic compounds (USEPA Method 8270D), Michigan 10 metals (USEPA Method 6010C), and PCBs (USEPA Method 8082A). Physical testing was performed for grain size (ASTM D6913/C136), material classification (ASTM D2487), moisture content (ASTM D2216), and weight per unit volume of uncompacted materials (ASTM D4254/C29).

A log of imported backfill materials delivered to the Site during the Work is included as **Table 5.2**. Backfill material testing results are included in **Appendices E** and **F**. Physical test results met the specifications for MDOT 21AA gravel and MDOT 2NS sand except for minor deviations from the specified gradation requirements that did not affect the ability of the materials to meet the intent of the design. All analytical test results were below the EGLE Part 201 Residential Direct Contact Cleanup Criteria and USEPA Removal Management Levels for Chemicals, dated May 2019 (USEPA 2019).

5.3.5 Post-Construction Material Stockpiles

Fill sand used as a leveling layer underneath the sediment processing pad and MDOT 21AA gravel used to construct temporary access roads were removed at the

conclusion of backfill placement activities and stockpiled at the contractor support area, as described in Sections 4.6.1 and 4.6.2, respectively.

Three stockpiles were generated at the contractor support area: one of the fill sand, one from gravel removed from the temporary access road located south of the sediment processing pad, and one from gravel removed from the temporary access road located north of the sediment processing pad. One composite sample was collected from each of these three material stockpiles and submitted for laboratory analysis of Michigan 10 metals and PCBs. All analytical results for the stockpiled materials were below EGLE Part 201 Residential Direct Contact Cleanup Criteria. As part of an agreement with the Village of Lake Linden, because all material stockpile sample results were below EGLE Part 201 Residential Direct Contact Cleanup Criteria, the material stockpiles were left at the contractor support area for future use by the Village. Material stockpile analytical reports are included in **Appendix M**.

5.3.6 Wipe Sample Results

Equipment that had been in contact with, or potentially in contact with, dredged materials was decontaminated via pressure washing prior to use for backfill activities or demobilization from the Site. Decontamination water generated during equipment decontamination was managed as described in Section 4.4.1. To verify the effectiveness of decontamination, wipe samples were collected from the decontaminated equipment and submitted for laboratory analysis of PCBs.

Wipe Sample Collection

Wipe samples were collected from the following equipment: a Komatsu D61 dozer, both Hydrema 912HM off-road trucks, a Komatsu WA380 front-end loader, the Komatsu PC400 long-reach excavator, and a CAT 330CL excavator. All sample

results were non-detect for PCBs. The laboratory report containing wipe sample results is included in **Appendix N**.

5.4 CONSTRUCTION QUALITY CONTROL AND ASSURANCE

5.4.1 Dredge Verification

Dredging operations were verified by surveys conducted by TriMedia Environmental & Engineering Services, LLC, (TriMedia) of Marquette, Michigan. Survey methods consisted of a combination of acoustic single beam and topographic methods based on water depths over the TCRA area. Pre dredge and post dredge survey data in a particular area were collected using the same survey techniques and were certified by TriMedia's Professional Licensed Surveyor in the State of Michigan. Dredge verification survey data was processed and compared on a 3-foot by 3-foot grid, and the comparison between pre- and post-dredge survey data was used to verify that dredging met the requirements of the technical specifications and engineering drawings in the RWP.

A final dredge survey comparison illustrating the extent of dredging operations conducted by the construction contractor and recommendations from the Project Respondent were provided to the USEPA OSC for review and concurrence before dredging was deemed complete and the construction contractor was allowed to proceed with subsequent phases of the Work. The USEPA OSC approved the completion of dredging on June 11, 2019. The final post-dredge conditions plan is included in **Appendix B**.

5.4.2 Backfill Material Placement Verification

Backfill material placement operations were verified by surveys conducted by TriMedia. Survey methods consisted of a combination of acoustic single-beam and topographic methods based on water depths over the TCRA area. Post-placement survey data were collected using the same techniques used to collect the final post-dredge surface survey and were certified by TriMedia's Professional Licensed Surveyor in the State of Michigan. Material placement verification survey data was processed and compared on a 3-foot by 3-foot grid. The final gravel placement and sand placement surveys were provided to the USEPA OSC for review with

Honeywell recommendations before material placement was deemed complete and the in-water work considered complete.

The final post-material placement conditions plan is provided as **Appendix B**.

5.5 CONSTRUCTION LESSONS LEARNED AND ADAPTIVE MANAGEMENT SOLUTIONS

As the Work progressed, some topics were identified during construction that required in-field investigations and decision-making by the Project Respondent's team to maintain an efficient construction schedule. This section describes those items, lessons learned, and field steps taken to adaptively manage the field program.

Because the majority of the TCRA area was in portions of the lake characterized by shallow water (less than 4 feet water depth), dredging and backfill operations were completed using conventional land based earthmoving equipment that accessed the TCRA area using interlocking HDPE mats. Due to elevated water levels, sediment conditions, and the existing bathymetry at the Site at the time of construction, additional measures were required to access a limited portion along the east edge of the TCRA area. To reach the east edge of the TCRA area, MDOT 21AA gravel was placed underneath the center and south finger roads to a height sufficient to provide land-based excavator access for dredging and subsequent backfilling. This revision to the access plan enabled the completion of the dredging and backfilling activities, although it required a sequential approach to backfill placement wherein both the gravel and sand layers were placed, surveyed, and approved along the east portion of the TCRA area before backfill placement occurred in the west portion of the TCRA area.

During dredging operations, surveys indicated that the design dredge elevations were not met at the offshore (east) edge of the TCRA area after multiple dredge passes, as discussed in Section 4.2. However, dredging was conducted in the area as observed by Honeywell's on-site representative, and the removed material was accounted for in processing and disposal. The cause was determined to be steep slopes in this area that resulted in minor sloughing of sediment toward toe of the slope in the dredged area. Water depths in this area were about 7 to 8 feet. On June 10, 2019, a request was made to USEPA to discontinue dredging along the east

edge of the TCRA area and proceed with backfill. USEPA approved this request in an email dated June 11, 2019, and backfill operations commenced at that time.

During placement of the gravel demarcation layer, post-backfill surveys for this layer indicated that the material was not holding on the dredged slopes along the east edge of the TCRA area, and in some areas material mounded at the toe of the slope in thicknesses greater than the specified 6 inches (up to 2 feet in isolated areas; see Section 4.5 for additional details). Rather than remove the additional gravel that accumulated at the toe of slope, the design and construction team recommended that the gravel remain in place and sand be placed using a thickness approach, with the additional requirement of placement of a minimum of 6 inches of sand, as a practical means to meet the intent of the TCRA. This minimum-thickness approach to backfill placement was consistent with Detail 2 in Drawing C-007 of the Backfill Plan design drawing and maintained the requirement for a 2 foot-minimum backfill thickness in all areas (except for the gravel-only area in the northwest portion of the TCRA area). USEPA approved this revised approach in an email dated June 18, 2019. For most of the TCRA area, the construction contractor placed 18 inches of sand backfill over the gravel backfill as originally required in the design, and in most areas, this approach essentially returned the area to pre-construction grade as planned in the design.

Analytical sampling of the construction water generated during dredging and dredged material management (Section 4.4.1) returned a pH measurement of 10.2. The elevated pH was likely the result of contact with the Calciment used as a stabilizing agent for the dredged sediments. To address the pH value, the construction contractor added muriatic acid to the construction water within the fractionation tank until the pH was lowered to approximately 8.5 prior to transport to the PLWSA for final treatment.

The adaptive management solutions described herein aided the successful completion of the TCRA to meet the objective to address potential public health and ecological risks within the Site attributable to elevated concentrations of PCBs and metals in sediment. The dredge design template was met in over 95% of the TCRA area, as specified in the design, with the remaining areas non contiguous and meeting with the performance requirements outlined in the RWP. Clean imported backfill materials were placed in the post-dredge footprint to minimize the potential for direct human or benthic contact with the impacted materials left in place by

design. The total material placement (gravel plus sand) was equal to or greater than 2 feet (+/- 6 inches) as verified through survey, essentially returning most of the area to pre-construction grade as planned in the design.

5.6 TCRA CONSTRUCTION COSTS

The cost incurred by Honeywell to complete the TCRA within the LLRA Area A was approximately $2,200,000. This value includes remedial design, contractor solicitation and procurement, construction-related costs for the construction contractor to complete the Work (including mobilization, site preparation, dredging, transport and disposal, backfill, site restoration, and demobilization), engineering construction management and construction quality assurance prior to, during, and after construction, and preparation of this Final Report.

6.0 POST-REMOVAL SITE CONTROL

This section summarizes post-construction survey conditions at the Site and planned future operation and maintenance activities.

6.1 AS-BUILT SURVEYS

Post-construction survey data was collected within the TCRA area on June 22, 2019, and in the upland remediation support area on July 1, 2019. These two data sets were combined into a single as-built survey of the TCRA area and adjacent upland area and were compared to target design elevations and pre-construction elevations as appropriate. The final as-built survey provided by the construction contractor was approved by Anchor QEA on July 12, 2019, and is included in **Appendix B**.

6.2 POST-REMOVAL SITE CONTROL PLAN

As required by the AOC, a post-removal site control plan will be prepared separately and provided to USEPA under separate cover. The site control plan will consist of regular post-construction surveys to verify that the installed backfill and cover remains in place and will provide recommendations for maintenance, if required. The surveys will cover the entire TCRA area, including the eastern portion of the dredge area where the contractor was not able to dredge the full 2-foot dredge cut due to apparent sloughing along the slope. The as-built survey data described in Section 5.4.2 will be the basis of comparison for the first post-construction survey, and each subsequent post-construction survey will be compared to the as built survey data and the prior post-construction survey.

7.0 REFERENCES

Anchor QEA, 2018. *Removal Work Plan Time Critical Removal Action*. Lake Linden Recreation Area (LLRA) – Area A. Prepared for U.S. Environmental Protection Agency on behalf of Honeywell. October 2018.

USEPA (U.S. Environmental Protection Agency), 2018. *Administrative Settlement Agreement and Order on Consent for Removal Action*. Lake Linden Recreation Area Sediments Site Lake Linden, Houghton County, Michigan.

USEPA, 2019. Removal Management Levels for Chemicals (RMLs). May 2019. Available at: https://www.epa.gov/risk/regional-removal-management-levels-chemicals-rmls.

8.0 CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Paul LaRosa

Paul T. LaRosa, PE
Project Respondent's Project Coordinator

9.0 LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cy	cubic yard
DU	Dredge Unit
EGLE	Michigan Department of Environment, Great Lakes, and Energy
HASP	Health and Safety Plan
HDPE	high-density polyethylene
LLDPE	linear low-density polyethylene
LLRA	Lake Linden Recreation Area
MDOT	Michigan Department of Transportation
NTU	nephelometric turbidity units
OSC	On-Scene Coordinator
OU	Operable Unit
PCB	polychlorinated biphenyl
PLWSA	Portage Lake Water and Sewage Authority
RTK-GPS	real-time kinematic differential global positioning system
RWP	Removal Work Plan
Sevenson	Sevenson Environmental Services
Site	LLRA Area A
TCLP	toxicity characteristic leaching procedure
TCRA	Time Critical Removal Action
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
Work	TCRA construction activities

TABLES

Table 4.1
Transportation and Disposal Log

Date	Time	Truck No.	Manifest No.	Weight (tons)
5/30/2019	0745	B&B Contracting Lic. No. RB 17782	001	28.66
5/30/2019	0745	B&B Contracting Lic. No. RB 17782	001A	22.57
5/30/2019	0800	Superior Sand & Gravel Truck No. 349	002	44.69
5/30/2019	1150	Superior Sand & Gravel Truck No. 349	003	45.51
5/30/2019	1225	B&B Contracting Lic. No. RB 17782	004A	25.31
5/30/2019	1225	B&B Contracting Lic. No. RB 17782	004B	23.08
5/31/2019	0735	B&B Contracting Lic. No. RB 17782	005	25.94
5/31/2019	0735	B&B Contracting Lic. No. RB 17782	006	21.15
5/31/2019	0750	Superior Sand & Gravel Truck No. 349	007	36.93
5/31/2019	0810	Superior Sand & Gravel Truck No. T354	008	42.62
5/31/2019	1130	Superior Sand & Gravel Truck No. 349	009	45.24
5/31/2019	1150	Superior Sand & Gravel Truck No. T354	010	37.89
6/3/2019	0740	B&B Contracting Truck No. 19	011	25.96
6/3/2019	0755	Superior Sand & Gravel Truck No. 349	012	47.13
6/3/2019	0805	Superior Sand & Gravel Truck No. T354	013	43.69
6/3/2019	0835	B&B Contracting Truck No. LC66617	014	20.36
6/3/2019	1110	Superior Sand & Gravel Truck No. 349	015	46.98
6/3/2019	1125	Superior Sand & Gravel Truck No. T354	016	41.92
6/3/2019	1150	B&B Contracting Truck No. LC66617	017	18.25
6/3/2019	1415	Superior Sand & Gravel Truck No. T354	018	48.10
6/4/2019	0730	B&B Contracting Truck No. 19	019	18.96
6/4/2019	0740	B&B Contracting Truck No. LC66617	020	41.22

Table 4.1
Transportation and Disposal Log

Date	Time	Truck No.	Manifest No.	Weight (tons)
6/4/2019	0935	Superior Sand & Gravel Truck No. T354	021	44.98
6/4/2019	0945	Superior Sand & Gravel Truck No. 349	022	50.05
6/4/2019	1010	B&B Contracting Truck No. 19	023	23.75
6/4/2019	1100	B&B Contracting Truck No. LC66617	024	40.58
6/4/2019	1110	B&B Contracting Lic. No. RB 17782	025	27.87
6/4/2019	1110	B&B Contracting Lic. No. RB 17782	026	24.36
6/4/2019	1250	Superior Sand & Gravel Truck No. T354	027	45.41
6/4/2019	1310	Superior Sand & Gravel Truck No. 349	028	45.63
6/5/2019	0735	B&B Contracting Lic. No. RB 17782	029	29.27
6/5/2019	0735	B&B Contracting Lic. No. RB 17782	030	24.38
6/5/2019	0745	B&B Contracting Truck No. LC66617	031	48.57
6/5/2019	0750	B&B Contracting Truck No. 19	032	22.06
6/5/2019	1300	B&B Contracting Lic. No. RB 17782	033	32.28
6/5/2019	1300	B&B Contracting Lic. No. RB 17782	034	19.75
6/5/2019	1310	B&B Contracting Truck No. LC66617	035	47.44
6/5/2019	1320	B&B Contracting Truck No. 19	037	22.40
6/6/2019	0730	B&B Contracting Lic. No. RB 17782	036	25.85
6/6/2019	0730	B&B Contracting Lic. No. RB 17782	038	20.70
6/6/2019	0735	B&B Contracting Truck No. 19	039	22.81
6/6/2019	0745	B&B Contracting Truck No. LC66617	040	42.75
6/6/2019	1030	B&B Contracting Truck No. 19	041	23.42
6/6/2019	1040	B&B Contracting Lic. No. RB 17782	042	28.58

Table 4.1
Transportation and Disposal Log

Date	Time	Truck No.	Manifest No.	Weight (tons)
6/6/2019	1040	B&B Contracting Lic. No. RB 17782	043	17.83
6/11/2019	0735	B&B Contracting Lic. No. RB 17782	044	30.37
6/11/2019	0735	B&B Contracting Lic. No. RB 17782	045	23.08
6/11/2019	0750	B&B Contracting Truck No. LC66617	047	50.36
6/11/2019	0755	B&B Contracting Truck No. 19	048	22.55
6/11/2019	0810	Portage Lake Construction Truck No. 36	049	33.13
6/11/2019	1055	B&B Contracting Lic. No. RB 17782	050	33.16
6/11/2019	1055	B&B Contracting Lic. No. RB 17782	051	22.59
6/11/2019	1105	B&B Contracting Truck No. 19	052	22.21
6/11/2019	1115	B&B Contracting Truck No. LC66617	053	35.04
6/11/2019	1130 (est.)	Superior Sand & Gravel Truck No. 349	054	43.58
6/12/2019	0730	B&B Contracting Lic. No. RB 17782	055	32.76
6/12/2019	0730	B&B Contracting Lic. No. RB 17782	056	23.89
6/12/2019	0740	B&B Contracting Truck No. LC66617	057	52.12
6/12/2019	0815	B&B Contracting Truck No. 19	058	26.80
6/12/2019	1115	B&B Contracting Truck No. LC66617	059	46.35
6/12/2019	1125	B&B Contracting Lic. No. RB 17782	060	25.02
6/12/2019	1125	B&B Contracting Lic. No. RB 17782	061	20.11
6/12/2019	1140	B&B Contracting Truck No. 19	062	22.30
6/13/2019	0730	B&B Contracting Lic. No. RB 17782	063	25.34
6/13/2019	0730	B&B Contracting Lic. No. RB 17782	064	20.78
6/13/2019	0740	B&B Contracting Truck No. LC66617	046	39.53

Table 4.1
Transportation and Disposal Log

Date	Time	Truck No.	Manifest No.	Weight (tons)
6/13/2019	1055	B&B Contracting Lic. No. RB 17782	065	26.69
6/13/2019	1055	B&B Contracting Lic. No. RB 17782	066	21.19
6/13/2019	1115	B&B Contracting Truck No. LC66617	067	41.05
6/14/2019	0730	B&B Contracting Truck No. LC66617	068	41.70
6/14/2019	0940	B&B Contracting Lic. No. RB 17782	069	28.11
6/14/2019	0940	B&B Contracting Lic. No. RB 17782	070	25.01
6/14/2019	1145	B&B Contracting Truck No. LC66617	071	42.71
6/17/2019	0845	B&B Contracting Truck No. LC66617	072	36.54
6/24/2019	0845	B&B Contracting Lic. No. RB 17782	073	26.4
6/24/2019	0845	B&B Contracting Lic. No. RB 17782	074	19.7
6/24/2019	0905	B&B Contracting Lic. No. BC11515	075	37.57
6/24/2019	1315	B&B Contracting Lic. No. RB 17782	076	30.76
6/24/2019	1315	B&B Contracting Lic. No. RB 17782	077	29.9
6/24/2019	1350	B&B Contracting Lic. No. BC11515	078	46.7
Total				**2,588**

Table 5.1
Turbidity Monitoring Results

Date	Time	Station → / Depth (feet) →	Early-Warning 10'	Early-Warning 20'	Compliance 10'	Compliance 20'
5/24/2019	0730		0.0	0.0	0.0	0.0
5/24/2019	1120		0.3	0.0	0.0	0.0
5/28/2019	0750		0.5	0.5	0.5	0.5
5/28/2019	1155		0.5	1.6	0.5	0.4
5/28/2019	1555		7.1	5.6	0.5	5.8
5/29/2019	0755		3.2	2.4	0.5	4.2
5/29/2019	1040		2.5	1.8	0.6	0.5
5/29/2019	1540		0.4	0.6	0.6	0.9
5/30/2019	0735		1.7	1.9	0.4	0.9
5/30/2019	1120		3.6	4.6	3.1	3.2
5/30/2019	1625		0.3	3.8	0.3	5.0
5/31/2019	0750		1.5	2.0	1.1	2.6
5/31/2019	1120		8.7	1.9	3.8	2.8
5/31/2019	1430		7.0	1.8	1.7	0.8
6/1/2019	0740		0.8	0.8	0.3	0.3
6/1/2019	1125		0.6	0.4	0.6	0.6
6/1/2019	1345		2.4	3.1	0.3	0.3
6/3/2019	0805		1.0	0.8	0.5	0.7
6/3/2019	1140		1.0	1.1	0.9	0.9
6/3/2019	1430		2.0	6.8	0.6	0.5
6/5/2019	0915		0.9	0.3	1.1	0.2
6/6/2019	0920		0.8	0.8	0.4	0.3
6/6/2019	1150		1.2	1.2	0.7	0.5
6/6/2019	1555		0.8	6.0	1.1	0.9
6/7/2019	0730		10.2	11.9	0.8	6.0
6/7/2019	1110		41.7[(1)]	9.8	9.2	0.8
6/7/2019	1535		5.2	22.4	8.0	0.9
6/10/2019	1000		1.0	0.3	1.1	1.1
6/11/2019	0735		0.9	20.2	1.0	6.2
6/11/2019	1100		1.5	5.7	1.1	3.5
6/11/2019	1515		2.0	2.8	4.2	0.8
6/12/2019	0740		1.0	3.0	1.8	1.8
6/12/2019	1110		2.1	3.2	1.6	1.1
6/12/2019	1500		10.6	1.6	1.6	0.9
6/13/2019	0730		6.7	17.8	2.4	6.4
6/13/2019	1120		1.4	8.2	1.6	5.8
6/13/2019	1440		2.1	3.2	2.4	3.8
6/14/2019	0745		1.4	2.3	0.9	1.4
6/14/2019	1110		0.9	15.5	0.8	1.0
6/14/2019	1345		1.8	9.4	8.2	16.2
6/15/2019	0725		5.7	1.2	5.7	0.8
6/15/2019	1145		8.3	1.4	1.2	1.0
6/15/2019	1335		6.6	1.4	1.4	1.2
6/17/2019	0740		0.2	1.7	0.3	2.0

Table 5.1
Turbidity Monitoring Results

Date	Time	Station → / Depth (feet) →	Early-Warning 10'	Early-Warning 20'	Compliance 10'	Compliance 20'
6/17/2019	1040		4.0	2.1	1.8	1.5
6/17/2019	1320		6.7	2.2	10.8	2.1
6/18/2019	0745		8.8	2.0	2.6	0.5
6/18/2019	1050		5.1	2.7	2.7	1.7
6/18/2019	1405		11.3	22.1	7.0	1.9
6/19/2019	0740		1.4	7.5	0.3	4.8
6/19/2019	1120		2.0	6.2	1.9	8.2
6/19/2019	1440		1.9	11.7	0.8	3.6
6/20/2019	0800		6.3	6.5	2.2	3.8
6/20/2019	1125		5.3	5.2	1.2	2.6
6/20/2019	1540		3.9	6.4	3.2	3.0
6/21/2019	0735		11.6	3.3	12.5	3.3
6/21/2019	1050		9.6	4.1	10.4	2.3
6/21/2019	1520		5.6	14.1	2.2	5.8
6/22/2019	0740		2.7	3.5	1.8	2.9
6/22/2019	1050		6.2	4.6	7.8	2.9

Notes:
• Early-warning station was positioned 100 feet outside of turbidity curtain
• Compliance station was positioned 300 feet outside of turbidity curtain
• All measurements are in nephelometric turbidity units
(1) In response to the elevated turbidity measurement at the early-warning station on 6/7/2019 at 11:10 a.m., R. Brown (Anchor QEA) and B. McAllister (Sevenson) inspected the turbidity curtain around the TCRA area. There were no signs of damage, tears, or billowing of the curtain. Visible turbidity was present outside of the curtain along the entire length of the curtain. Potential causes of turbidity outside the curtain were concluded to be either turbidity escaping underneath the curtain or turbidity moving through the mesh of the permeable curtain.

Table 5.2
Imported Backfill Material Delivery Log

Date	Ticket No.	21AA Gravel (tons)	2NS Sand (tons)	Fill Sand (cy)
5/3/2019	2093428	19.9		
5/3/2019	2093429	19.25		
5/3/2019	2092430	19.54		
5/3/2019	2093435	21.49		
5/3/2019	2093436	18.3		
5/3/2019	2093438	17.61		
5/3/2019	2093439	19.44		
5/3/2019	2093440	19.01		
5/3/2019	2093441	18.07		
5/3/2019	2093443	19.56		
5/3/2019	2093446	20.36		
5/3/2019	206685			15
5/6/2019	2093464	19.39		
5/6/2019	2093465	19.56		
5/6/2019	2093466	48.83		
5/6/2019	2093467	19.5		
5/6/2019	2093468	19.47		
5/6/2019	2093470	47.96		
5/6/2019	2093471	19.37		
5/6/2019	2093472	48.4		
5/6/2019	2093473	49.8		
5/7/2019	2093474	44.6		
5/7/2019	2093479	47.09		
5/7/2019	2093480	46.65		
5/7/2019	206674			32
5/7/2019	206675			34
5/7/2019	206680			32
5/7/2019	206684			32
5/8/2019	206676			34
5/8/2019	206681			32
5/8/2019	206677			32
5/8/2019	206682			32
5/9/2019	2093484	41.69		
5/9/2019	2093486	47.94		
5/9/2019	2093487	47.73		
5/9/2019	2093488	48.05		
5/10/2019	206683			32
5/13/2019	2093504	45.22		
5/13/2019	2093507	44.90		
5/14/2019	2093521	44.57		
5/14/2019	2093522	46.77		
5/14/2019	2093525	46.21		
5/14/2019	2093528	44.30		
5/16/2019	2093599	44.59		
5/16/2019	2093606	47.16		

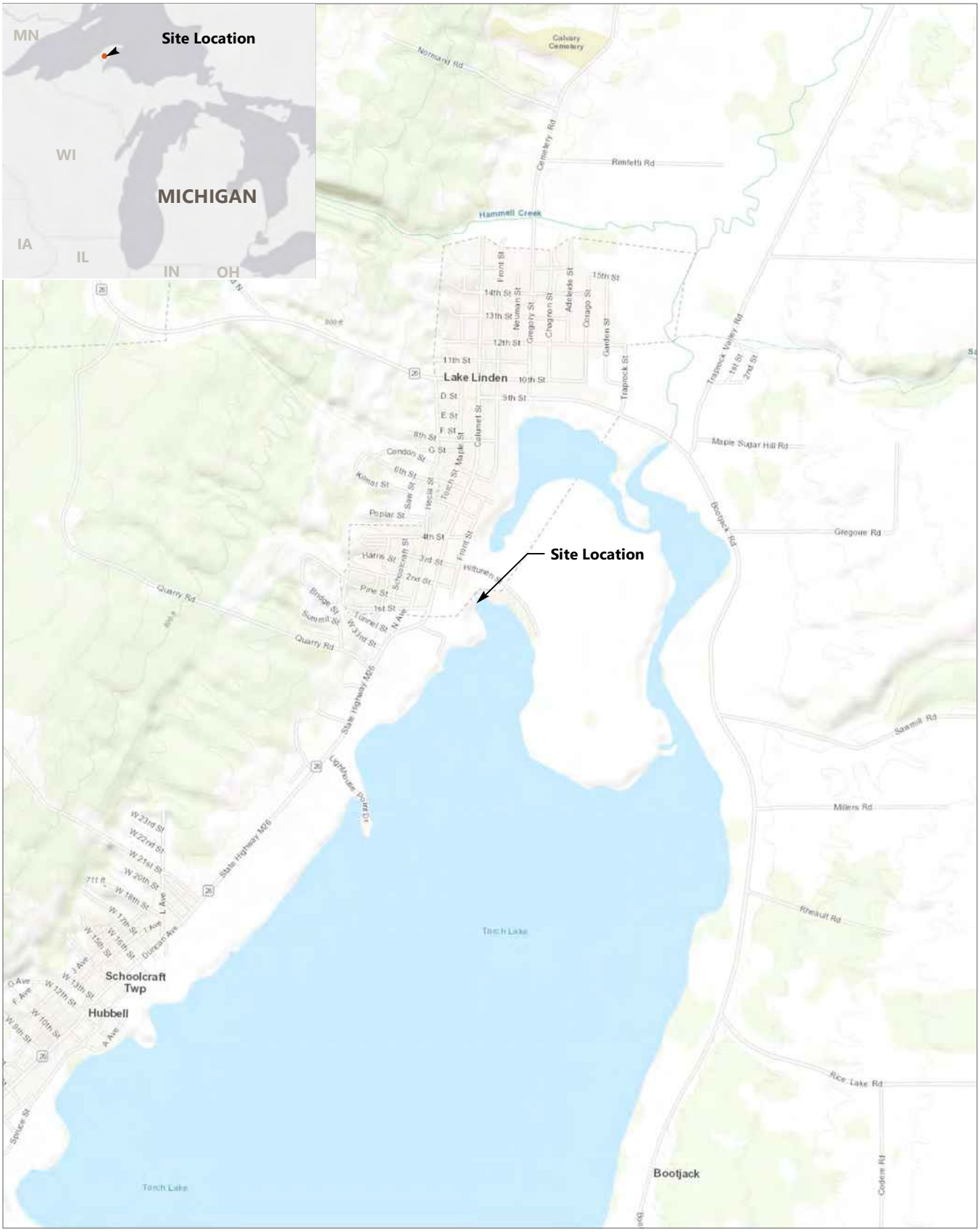
Table 5.2
Imported Backfill Material Delivery Log

Date	Ticket No.	21AA Gravel (tons)	2NS Sand (tons)	Fill Sand (cy)
5/16/2019	2093607	43.78		
5/16/2019	2093611	48.11		
5/16/2019	2093613	46.65		
5/16/2019	2093617	49.17		
5/16/2019	2093618	45.54		
5/16/2019	2093623	48.49		
5/29/2019	2093830	47.23		
5/29/2019	2093832	47.11		
5/29/2019	2093835	47.95		
5/29/2019	2093836	48.81		
5/29/2019	2093839	47.81		
5/29/2019	2093840	48.79		
5/29/2019	2093843	46.52		
5/29/2019	2093845	46.84		
5/29/2019	2093849	47.70		
5/29/2019	2093851	47.59		
5/29/2019	2093854	48.16		
5/29/2019	2093861	47.75		
5/29/2019	2093864	48.98		
6/4/2019	206727		46.50	
6/4/2019	206729		47.52	
6/4/2019	206735		47.33	
6/4/2019	206736		47.05	
6/7/2019	2094315	47.08		
6/7/2019	2094324	48.39		
6/7/2019	2094326	47.18		
6/7/2019	2094333	47.17		
6/7/2019	2094337	49.06		
6/7/2019	2094339	48.42		
6/12/2019	207055		48.73	
6/12/2019	207056		46.95	
6/12/2019	207060		48.24	
6/12/2019	207062		47.67	
6/12/2019	207063		47.93	
6/12/2019	207069		47.56	
6/12/2019	2094477	47.62		
6/12/2019	2094487	48.73		
6/12/2019	2094488	48.45		
6/12/2019	2094497	47.22		
6/12/2019	207073		47.99	
6/12/2019	207077		47.38	
6/13/2019	2094517	47.24		
6/13/2019	2094525	47.96		
6/13/2019	2094534	47.51		
6/13/2019	2094537	48.06		

Table 5.2
Imported Backfill Material Delivery Log

Date	Ticket No.	21AA Gravel (tons)	2NS Sand (tons)	Fill Sand (cy)
6/14/2019	2094558	47.81		
6/14/2019	2094561	47.87		
6/18/2019	207177		47.19	
6/18/2019	207178		47.80	
6/18/2019	2094657	48.58		
6/18/2019	2094659	48.14		
6/18/2019	207193		47.87	
6/18/2019	207195		48.09	
6/18/2019	207202		48.08	
6/18/2019	207206		48.54	
6/18/2019	207209		47.14	
6/18/2019	207212		47.66	
6/18/2019	207219		47.24	
6/18/2019	207222		47.04	
6/20/2019	207255		47.67	
6/20/2019	207258		47.84	
6/20/2019	207263		48.45	
6/20/2019	207266		48.33	
6/21/2019	207285		48.23	
6/21/2019	207286		48.48	
6/21/2019	207289		47.79	
6/21/2019	207290		48.80	
6/21/2019	207293		48.53	
6/21/2019	207295		48.55	
6/21/2019	207296		48.17	
6/21/2019	207298		48.76	
6/21/2019	207300		47.63	
6/21/2019	207301		49.94	
6/21/2019	207309		48.97	
Total		**2,958**	**1,774**	**307**

FIGURES



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ANCHOR QEA

0 2,000
Feet

Figure 1.1
Lake Linden Site and Vicinity Map
Time Critical Removal Action
Lake Linden Recreation Area (LLRA) – Area A

LEGEND:

- Sand Cover Placement Only
- Dredge and Backfill Area
- Time Critical Removal Action Area

NOTES:

1. Area Boundaries provided by USEPA and Ramboll.
2. The Southern boundary of Area A was revised in August 2018 to align with the boundary of the planned Time Critical Removal Action.
3. USEPA: U.S. Environmental Protection Agency
4. Aerial Image from Google Earth dated 6/06/2017.

0 200
Feet

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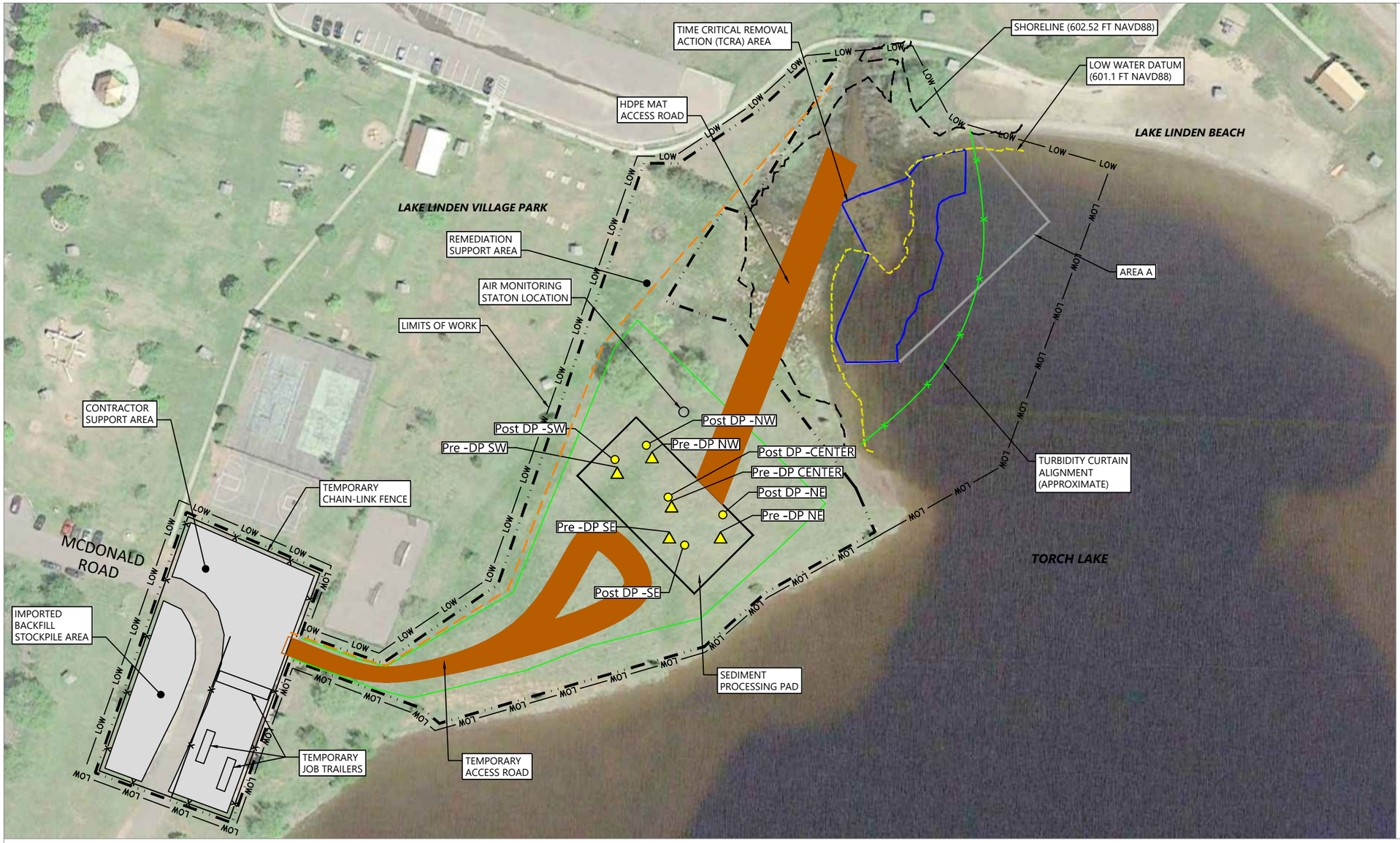
ANCHOR QEA

Figure 1.2
Lake Linden Recreation Area
Time Critical Removal Action
Lake Linden Recreation Area (LLRA) – Area A



SURVEYING NOTES:

1. THE SHORELINE (I.E. ZERO WATER DEPTH LINE) WAS DEFINED AND SURVEYED AT 602.52 FT NAVD88 BY AFFILIATED RESEARCHERS LLC, ON JULY 10, 2018.
2. APPROXIMATE LOCATIONS OF TEMPORARY FACILITIES, SEDIMENT PROCESSING AND DEWATERING AREA, AND ACCESS ROADS DIGITIZED FROM SEVENSON ENVIRONMENTAL SERVICES, INC. SITE LAYOUT PLAN DATED 9/7/18.

LEGEND:

- TIME CRITICAL REMOVAL ACTION (TCRA) AREA
- AREA A
- LOW — LIMITS OF WORK
- SHORELINE (602.52 FT NAVD88)
- LOW WATER DATUM (601.1 FT NAVD88
- STAGING AREA
- EROSION AND SEDIMENTATION CONTROLS (SILT FENCE AND STRAW WATTLES)
- PRE-DREDGE UPLAND SOIL SAMPLE
- POST-REMEDIATION UPLAND SOIL SAMPLE
- ORANGE CONSTRUCTION FENCING
- CHAIN LINK FENCE
- TURBIDITY CURTAIN
- AIR MONITORING STATION

HORIZONTAL DATUM: MICHIGAN STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET
VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), U.S. SURVEY FEET

0 100
Feet

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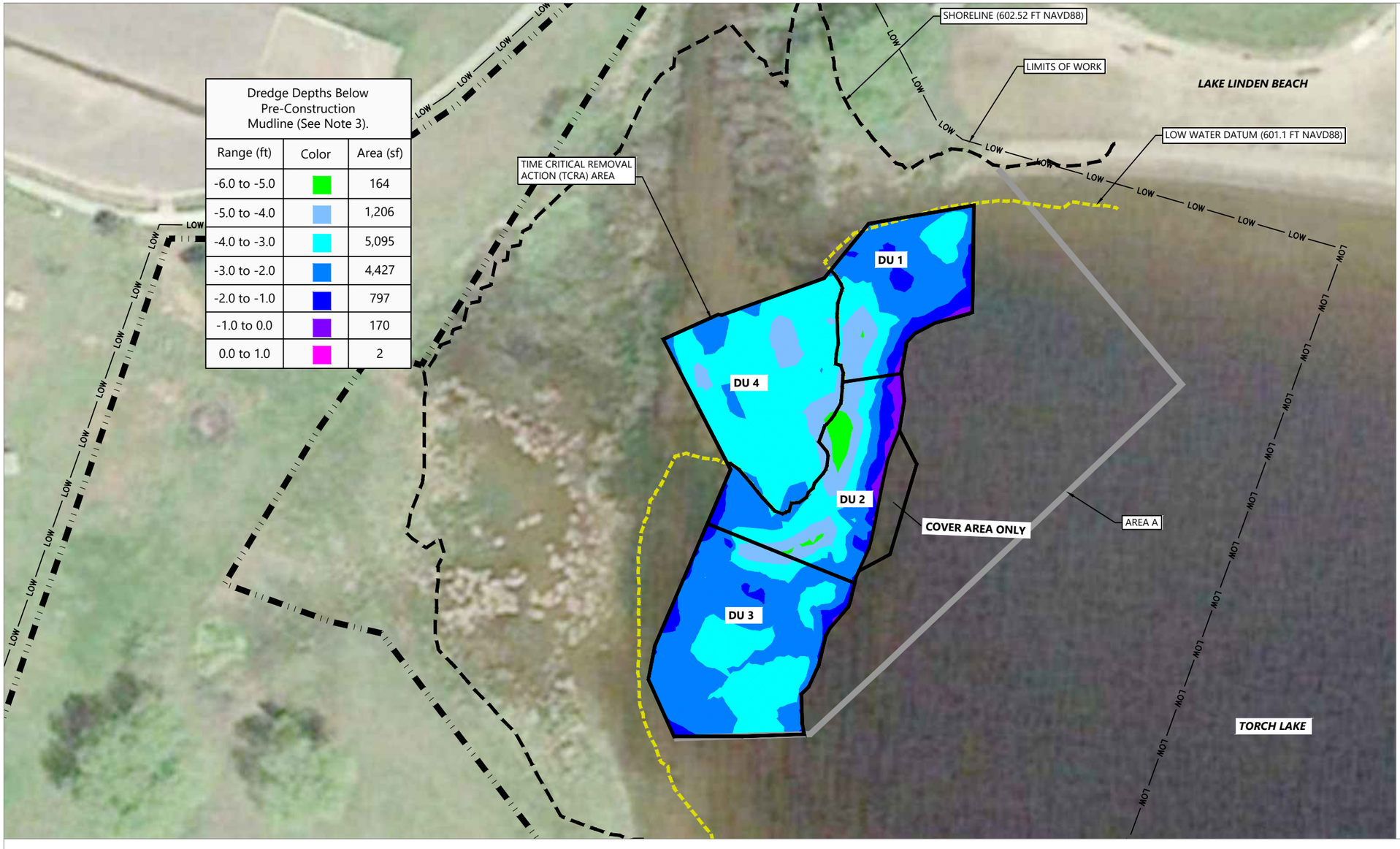
Filepath: K:\Projects\0287-Honeywell International Inc\Lake Linden\CONSTRUCTION FIGURES\20190807 Construction Survey Figure 4.1.dwg Figure 4.1

ANCHOR QEA

Figure 4.1
Upland Staging Area Site Plan

Lake Linden Recreation Area (LLRA)
Lake Linden, MI



SURVEYING NOTES:

1. PRE-CONSTRUCTION SURVEY COLLECTED BY TRIMEDIA ON APRIL 25, 2019. POST-DREDGE SURVEY COLLECTED BY TRIMEDIA ON JUNE 11, 2019.
2. THE SHORELINE (I.E. ZERO WATER DEPTH LINE) WAS DEFINED AND SURVEYED AT 602.52 FT NAVD88 BY AFFILIATED RESEARCHERS LLC, ON JULY 10, 2018.
3. FIGURE SHOWS DREDGE CUT DEPTH BASED ON A COMPARISON OF PRE-CONSTRUCTION SURVEY (BASE) VS. POST-DREDGE SURVEY - NEGATIVE VALUES SHOW WHERE POST-DREDGE SURVEY ELEVATIONS ARE BELOW PRE-CONSTRUCTION SURVEY ELEVATIONS (I.E. DREDGING WAS CONDUCTED).

LEGEND:

- TIME CRITICAL REMOVAL ACTION (TCRA) AREA
- LOW — LIMITS OF WORK
- SHORELINE (602.52 FT NAVD88)
- AREA A
- DU 2 — DREDGE UNIT
- LOW WATER DATUM (601.1 FT NAVD88)
- STAGING AREA

NOTE: AERIAL IMAGERY FROM GOOGLE EARTH PRO, 2018
HORIZONTAL DATUM: MICHIGAN STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET
VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), U.S. SURVEY FEET

Base Survey - From Trimedia on April 25, 2019 (0287 Lake Linden PRE CONSTRUCTION 20190605)
Comparison Survey - From Trimedia on June 11, 2019 (0287 Lake Linden POST CONSTRUCTION 20190611)

0 40
Feet

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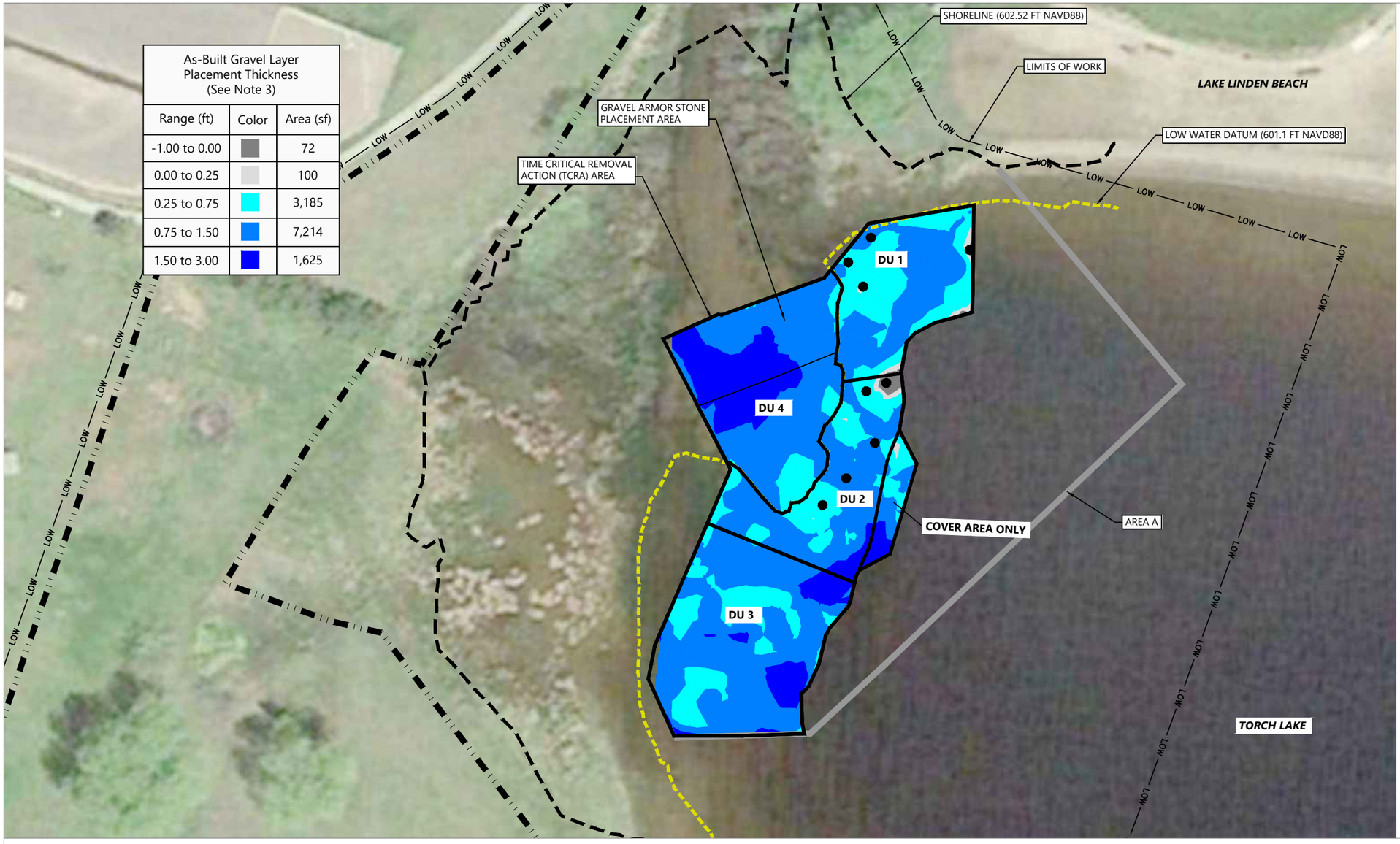
ANCHOR QEA

Figure 4.2
As-Built Dredge Depths Below Pre-Construction Mudline

Lake Linden Recreation Area (LLRA)
Lake Linden, MI



SURVEYING NOTES:

1. POST-DREDGE SURVEY COLLECTED BY TRIMEDIA ON JUNE 11, 2019. POST-GRAVEL SURVEY COLLECTED BY TRIMEDIA ON JUNE 20, 2019.
2. THE SHORELINE (I.E. ZERO WATER DEPTH LINE) WAS DEFINED AND SURVEYED AT 602.52 FT NAVD88 BY AFFILIATED RESEARCHERS LLC, ON JULY 10, 2018.
3. FIGURE SHOWS GRAVEL BACKFILL PLACEMENT THICKNESS BASED ON A COMPARISON OF POST-DREDGE SURVEY (6/11/19; BASE) VS. POST-GRAVEL SURVEY (6/20/19) - POSITIVE VALUES SHOW WHERE POST-GRAVEL SURVEY IS ABOVE POST-DREDGE SURVEY (I.E. GRAVEL PLACED).

LEGEND:

- TIME CRITICAL REMOVAL ACTION (TCRA) AREA
- LOW — LIMITS OF WORK
- SHORELINE (602.52 FT NAVD88)
- AREA A
- DU 2 — DREDGE UNIT
- LOW WATER DATUM (601.1 FT NAVD88)
- STAGING AREA
- PROBE LOCATIONS

NOTE: AERIAL IMAGERY FROM GOOGLE EARTH PRO, 2018
HORIZONTAL DATUM: MICHIGAN STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET
VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), U.S. SURVEY FEET

Base Survey - From Trimedia on June 11, 2019 (0287 Lake Linden POST CONSTRUCTION 20190611)
Comparison Survey - From Trimedia on June 20, 2019 (0287 Lake Linden PRE CONSTRUCTION 20190625A GRAVEL)

0 40
Feet

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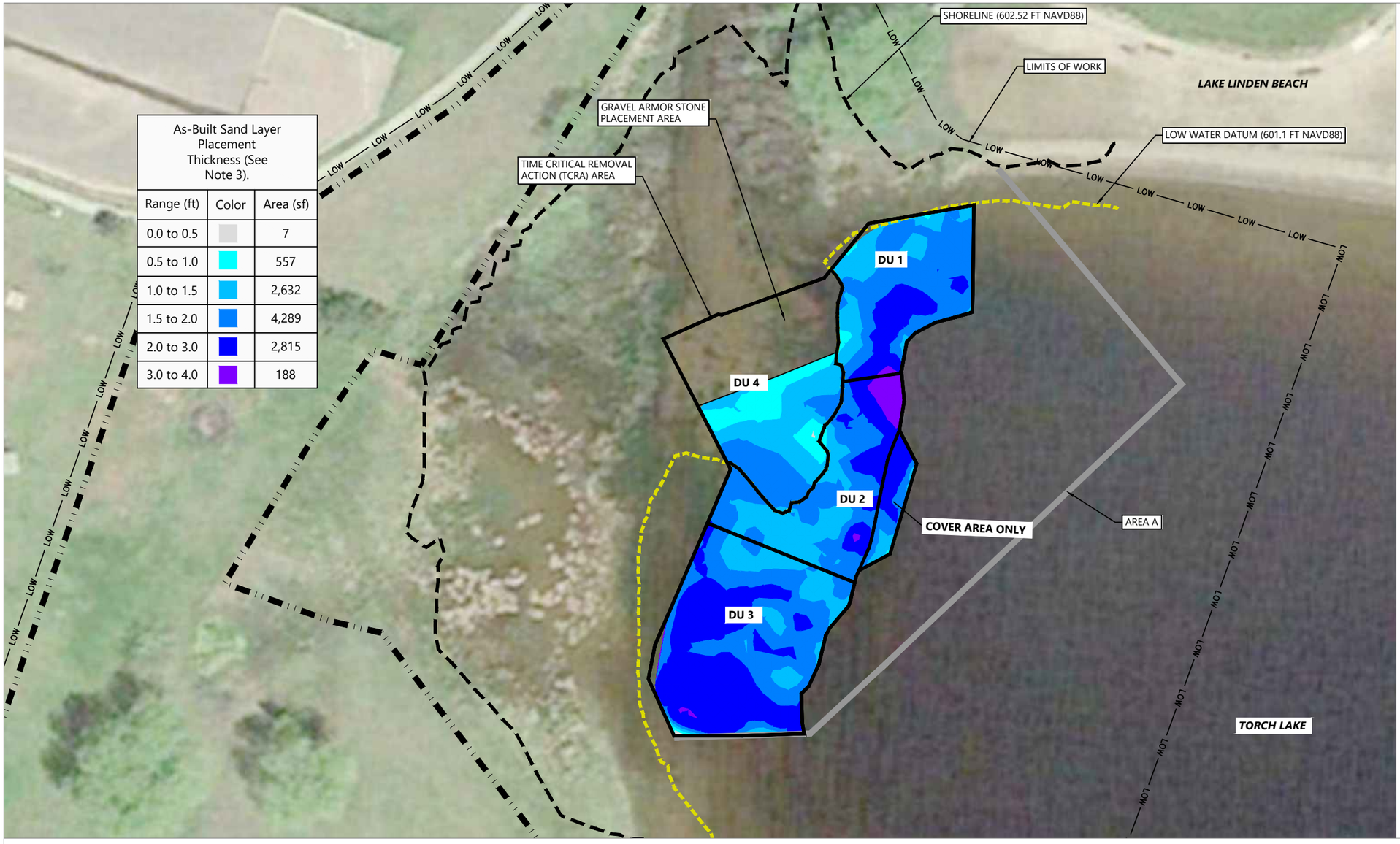
Filepath: K:\Projects\0287-Honeywell International Inc\Lake Linden\CONSTRUCTION FIGURES\20190807 Construction Survey Figure 4.3.dwg Figure 4.3

ANCHOR QEA

Figure 4.3
As-Built Gravel Layer Placement Thickness

Lake Linden Recreation Area (LLRA)
Lake Linden, MI



SURVEYING NOTES:

1. POST-GRAVEL SURVEY COLLECTED BY TRIMEDIA ON JUNE 20, 2019. POST-SAND SURVEY COLLECTED BY TRIMEDIA ON JUNE 22, 2019.
2. THE SHORELINE (I.E. ZERO WATER DEPTH LINE) WAS DEFINED AND SURVEYED AT 602.52 FT NAVD88 BY AFFILIATED RESEARCHERS LLC, ON JULY 10, 2018.
3. FIGURE SHOWS SAND BACKFILL PLACEMENT THICKNESS BASED ON A COMPARISON OF POST-GRAVEL SURVEY (6/20/19; BASE) VS. POST-SAND SURVEY (6/22) - POSITIVE VALUES SHOW WHERE POST-SAND SURVEY ELEVATIONS ARE ABOVE POST-GRAVEL SURVEY ELEVATIONS (I.E. SAND WAS PLACED)

LEGEND:

- TIME CRITICAL REMOVAL ACTION (TCRA) AREA
- LOW — LIMITS OF WORK
- SHORELINE (602.52 FT NAVD88)
- AREA A
- DU 2 — DREDGE UNIT
- LOW WATER DATUM (601.1 FT NAVD88)
- STAGING AREA

NOTE: AERIAL IMAGERY FROM GOOGLE EARTH PRO, 2018
HORIZONTAL DATUM: MICHIGAN STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET
VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), U.S. SURVEY FEET

Base Survey - From Trimedia on June 20, 2019 (0287 Lake Linden PRE CONSTRUCTION 20190625A GRAVEL)
Comparison Survey - From Trimedia on June 22, 2019 (0287 Lake Linden PRE CONSTRUCTION 20190622 SAN)

0 40
Feet

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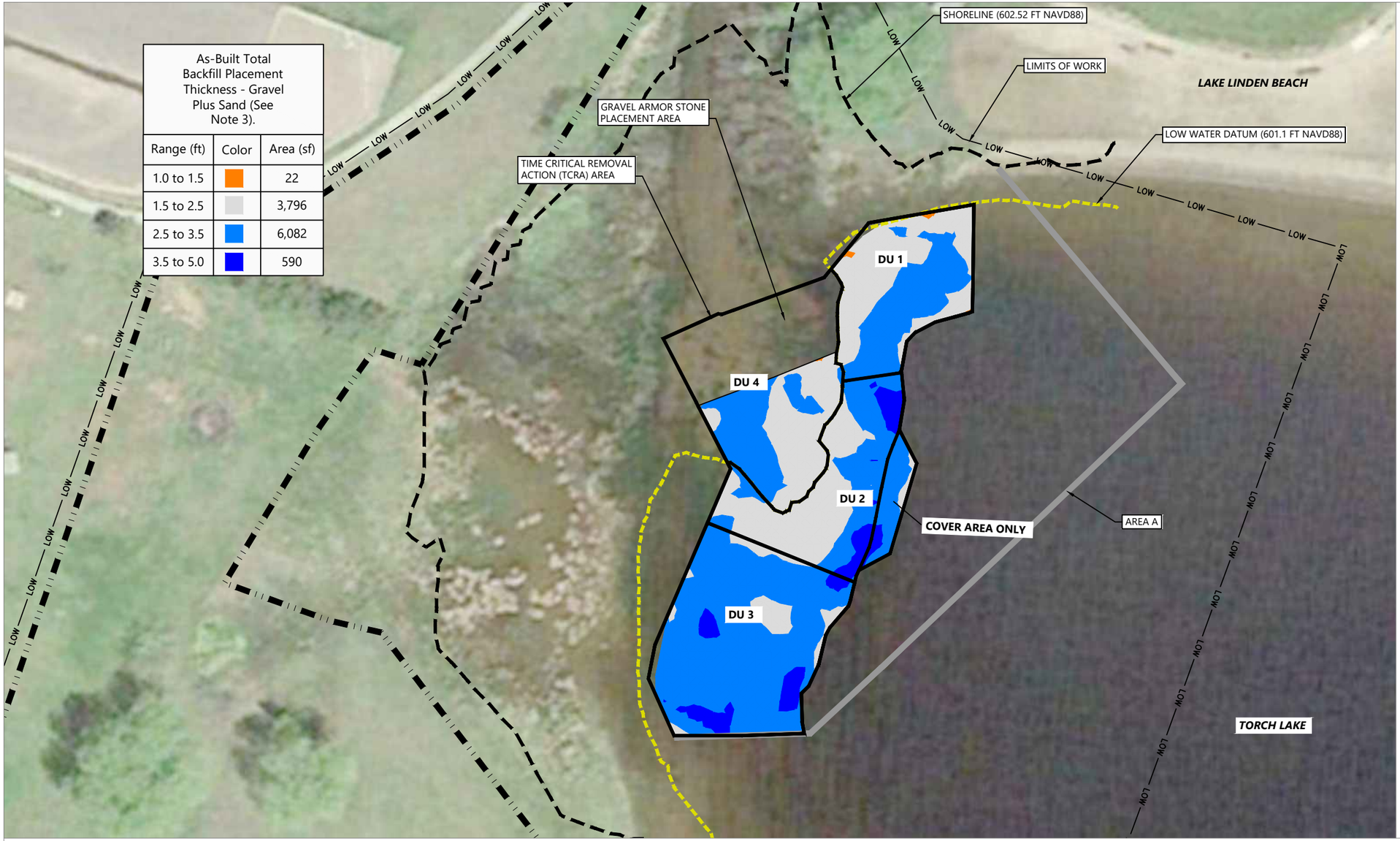
Filepath: K:\Projects\0287-Honeywell International Inc\Lake Linden\CONSTRUCTION FIGURES\20190807 Construction Survey Figure 4.4.dwg Figure 4.4

ANCHOR QEA

Figure 4.4
As-Built Sand Placement Thickness

Lake Linden Recreation Area (LLRA)
Lake Linden, MI



SURVEYING NOTES:

1. POST-DREDGE SURVEY COLLECTED BY TRIMEDIA ON JUNE 11, 2019. POST-SAND SURVEY COLLECTED BY TRIMEDIA ON JUNE 22, 2019.
2. THE SHORELINE (I.E. ZERO WATER DEPTH LINE) WAS DEFINED AND SURVEYED AT 602.52 FT NAVD88 BY AFFILIATED RESEARCHERS LLC, ON JULY 10, 2018.
3. FIGURE SHOWS TOTAL BACKFILL PLACEMENT THICKNESS BASED ON A COMPARISON OF POST-DREDGE SURVEY (6/11/19; BASE) VS. POST-SAND SURVEY (6/22/19) - POSITIVE VALUES SHOW WHERE POST-SAND SURVEY IS ABOVE POST-DREDGE SURVEY.
4. "GRAY" AREAS MET THE DESIGN REQUIREMENTS OF A TOTAL PLACEMENT OF 2 FEET +/- 6 INCHES. "ORANGE" AREAS DO NOT MEET THE DESIGN REQUIREMENTS. "BLUE" AREAS EXCEED THE DESIGN REQUIREMENTS.

LEGEND:

- TIME CRITICAL REMOVAL ACTION (TCRA) AREA
- LOW — LIMITS OF WORK
- SHORELINE (602.52 FT NAVD88)
- AREA A
- DU 2 — DREDGE UNIT
- LOW WATER DATUM (601.1 FT NAVD88)
- STAGING AREA

NOTE: AERIAL IMAGERY FROM GOOGLE EARTH PRO, 2018
HORIZONTAL DATUM: MICHIGAN STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET
VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), U.S. SURVEY FEET

Base Survey - From Trimedia on June 11, 2019 (0287 Lake Linden POST CONSTRUCTION 20190611)
Comparison Survey - From Trimedia on June 22, 2019 (0287 Lake Linden PRE CONSTRUCTION 20190622 SAN)

0 40
Feet

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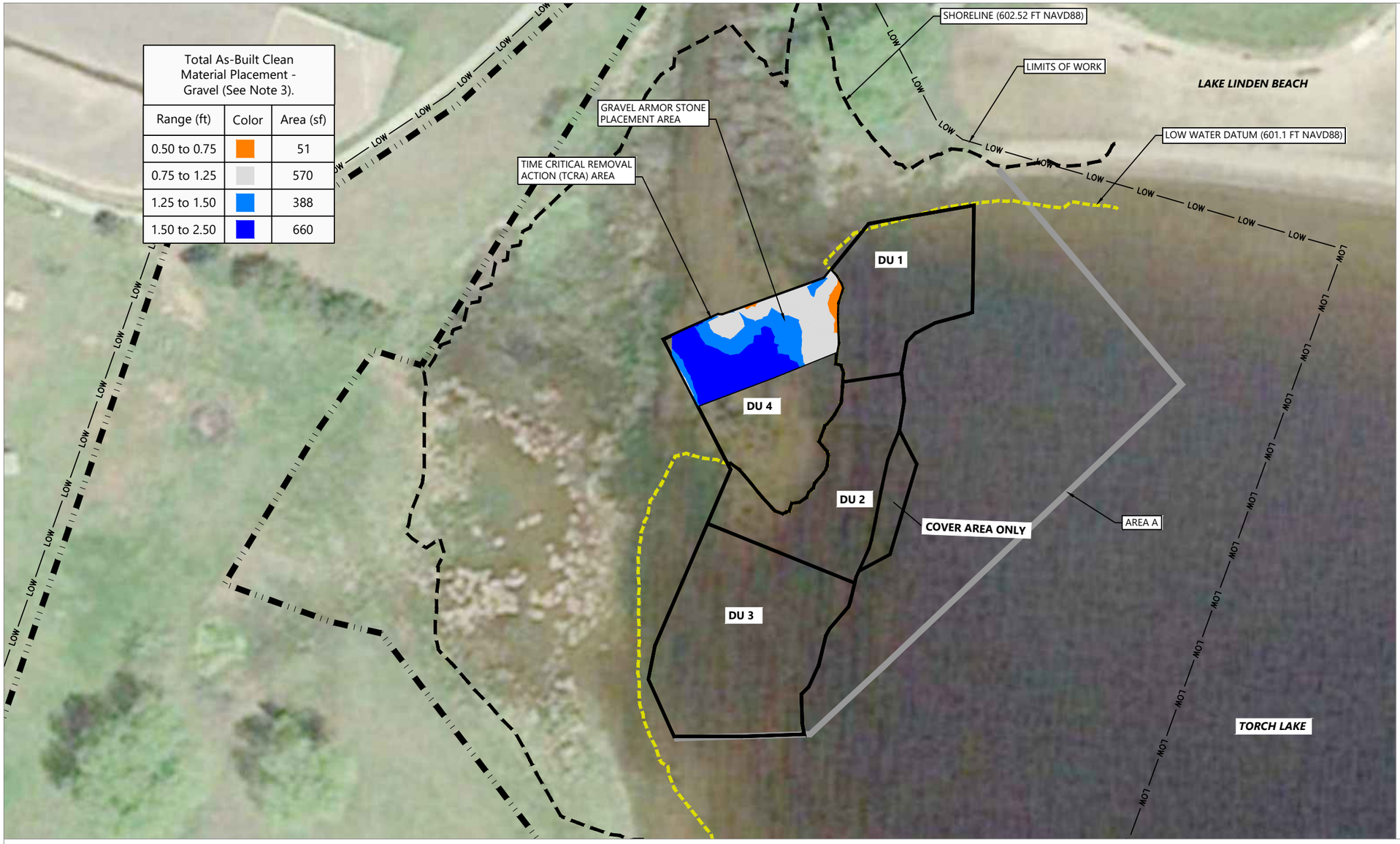
ANCHOR QEA

Figure 4.5
Total As-Built Clean Material Placement (Gravel Plus Sand)

Lake Linden Recreation Area (LLRA)
Lake Linden, MI

Total As-Built Clean Material Placement - Gravel (See Note 3).		
Range (ft)	Color	Area (sf)
0.50 to 0.75		51
0.75 to 1.25		570
1.25 to 1.50		388
1.50 to 2.50		660



SURVEYING NOTES:

1. POST-DREDGE SURVEY COLLECTED BY TRIMEDIA ON JUNE 11, 2019. POST-GRAVEL SURVEY COLLECTED BY TRIMEDIA ON JUNE 20, 2019.
2. THE SHORELINE (I.E. ZERO WATER DEPTH LINE) WAS DEFINED AND SURVEYED AT 602.52 FT NAVD88 BY AFFILIATED RESEARCHERS LLC, ON JULY 10, 2018.
3. FIGURE SHOWS GRAVEL BACKFILL PLACEMENT THICKNESS IN AREA TARGETED FOR GRAVEL BACKFILL ONLY (NO OVERLYING SAND) BASED ON A COMPARISON OF POST-DREDGE SURVEY (6/11/19; BASE) VS. POST-GRAVEL SURVEY (6/20/19) - POSITIVE VALUES SHOW WHERE POST-GRAVEL SURVEY IS ABOVE POST-DREDGE SURVEY (I.E., GRAVEL PLACED).
4. "GRAY" AREAS MET THE DESIGN REQUIREMENT OF A TOTAL OF 12 INCHES OF GRAVEL PLACEMENT +/- 3 INCHES. ORANGE AREAS DO NOT MEET DESIGN REQUIREMENT. BLUE AREAS EXCEED DESIGN REQUIREMENT.

LEGEND:

- TIME CRITICAL REMOVAL ACTION (TCRA) AREA
- LOW — LIMITS OF WORK
- SHORELINE (602.52 FT NAVD88)
- AREA A
- DU 2 — DREDGE UNIT
- LOW WATER DATUM (601.1 FT NAVD88)
- STAGING AREA

NOTE: AERIAL IMAGERY FROM GOOGLE EARTH PRO, 2018
HORIZONTAL DATUM: MICHIGAN STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET
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Comparison Survey - From Trimedia on June 20, 2019 (0287 Lake Linden PRE CONSTRUCTION 20190625A GRAVEL)

0 40
Feet

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Filepath: K:\Projects\0287-Honeywell International Inc\Lake Linden\CONSTRUCTION FIGURES\20190807 Construction Survey Figure 4.6.dwg Figure 4.6

ANCHOR QEA

Figure 4.6
Total As-Built Material Placement (Gravel)

Lake Linden Recreation Area (LLRA)
Lake Linden, MI