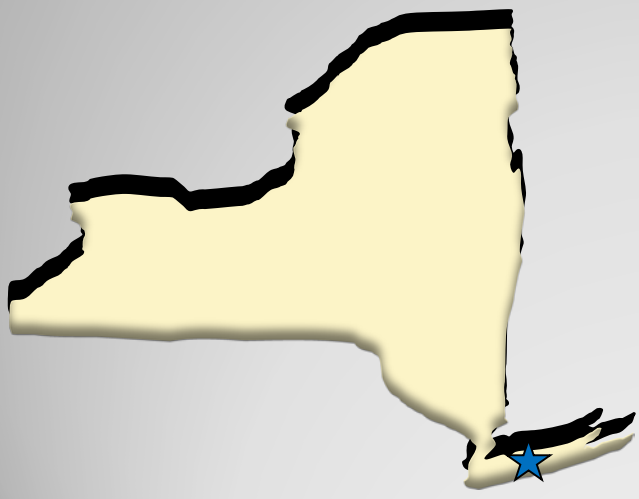
FINAL FEASIBILITY STUDY REPORT

Dzus Fastener Company, Inc. (152033)
West Islip, New York

Operable Unit 4 – Lake Capri



Prepared for:

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

New York State Department of Environmental Conservation
Division of Environmental Remediation

Prepared by:

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EA SCIENCE and TECHNOLOGY

September 2018

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West Islip, New York

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Prepared for

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EA Project No. 14907.33

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LIST OF ACRONYMS AND ABBREVIATIONS

AECOM	Architecture, Engineering, Consulting, Operations, and Maintenance
ARARs	Appropriate or relevant and applicable requirements
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of federal regulations
COC	Contaminant of concern
cy	Cubic yard
DER	Division of Environmental Remediation
EA	EA Engineering, P.C. and Its Affiliate EA Science and Technology
EPA	U. S. Environmental Protection Agency
FS	Feasibility study
ft	Feet (foot)
GRA	General response actions
in.	Inch(es)
IRM	Interim remedial measure
No.	Number
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
OU	Operable unit
ppm	Parts per million
RAO	Remedial action objectives
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
ROD	Record of decision
SCG	Standards, Criteria, and Guidance
SCOs	Soil Cleanup Objective(s)
SGV	Sediment Guidance Value
SPDES	State Permit Discharge Elimination System

1. INTRODUCTION AND PROJECT OVERVIEW

EA Engineering, P.C. and its affiliate EA Science and Technology (EA), under Contract to the New York State Department of Environmental Conservation (NYSDEC) (Work Assignment Number [No.] D007624-33) was tasked to perform a Remedial Investigation (RI) and Feasibility Study (FS) at the Dzus Fastener Company, Inc. site (NYSDEC Site Number No. 152033) located in West Islip, Suffolk County, New York (**Figure 1-1**). The site is listed as a Class 2 in the State Registry of Inactive Hazardous Waste Sites (list of State Superfund sites); this site represents a significant threat to public health or the environment, and action is required. The site consists of four operable units (OUs) defined as follows:

- OU1 consisted of the leaching pools (the source) and areas of soil contamination at the facility. A Record of Decision (ROD) was issued for this OU by NYSDEC in March 1995. The selected remedy consisted of in situ stabilization/solidification for onsite soils containing cadmium at concentrations greater than 10 parts per million (ppm).

- OU2 was comprised of the offsite contamination including sediment and water contamination for a section of Willetts Creek and Lake Capri (**Figure 1-2**). A ROD for OU2 was issued by NYSDEC in October 1997. The selected remedy included dredging, dewatering, and offsite disposal of contaminated sediments from Lake Capri; excavation and offsite disposal of sediment from Willetts Creek exceeding 9 ppm.

- OU3 encompasses the area of offsite impacted wetlands located behind a strip mall on Union Boulevard and is inclusive of the Willetts Creek channel up to approximately 700 feet (ft) upstream of Lake Capri. OU3 was found to be contaminated during routine post-remedial action effectiveness sampling (Architecture, Engineering, Consulting, Operations, and Maintenance [AECOM] 2016).

- OU4 encompasses the lower portion of Willetts Creek south of OU3, Lake Capri and the surrounding floodplain, and the tidal portion of Willetts Creek south of Lake Capri (approximately 1,600 ft south of Montauk Highway). Lake Capri and a section of Willetts Creek was previously managed as a component of OU2 but is included as part of OU4 since it was found to be re-contaminated after the OU2 remedy was completed. Although the Willetts Creek tidal area was considered a component of OU4 for the RI, it is not included in the FS. The tidal area will be managed as a separate operable unit (OU5).

The boundaries of all OUs are shown in **Figure 1-3**. OU4 is the focus of this FS Report.

1.1 PURPOSE AND SCOPE

This FS Report was prepared to develop and evaluate alternatives for remedial action, determine which alternative is the most protective of public health and the environment, and conforms to relevant and appropriate Standards, Criteria, and Guidance (SCGs) for OU4 at the Dzus Fastener Company, Inc. site.

This FS Report was prepared in accordance with the most recent versions of the *Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act* (United States Environmental Protection Agency [EPA] 1988) and Division of Environmental Remediation (DER)-10, *Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010).

1.2 REPORT ORGANIZATION

This FS report has been organized as follows:

- ***Section 1***—Introduction and Project Overview
- ***Section 2***—Summary of OU4 Remedial Investigation and Exposure Assessment
- ***Section 3***—Development of Remedial Action Objectives (RAOs)
- ***Section 4***—General Response Actions (GRAs)
- ***Section 5***—Identification and Screening of Technologies
- ***Section 6***—Scoping and Development of Remedial Alternatives
- ***Section 7***—Costing and Evaluation Criteria
- ***Section 8***—Detailed Analysis of Alternatives and Recommendations
- ***Section 9***—References.

1.3 BACKGROUND

1.3.1 Site Location

The Dzus Fastener Company, Inc. site is located at 425 Union Boulevard, West Islip, Suffolk County, New York. The onsite area, assigned NYSDEC Site No. 152033, is a 1-acre space that once contained the source area (leaching pools) that were the subject of OU1 remedial action. Now a parking lot, the site is in a mixed residential, commercial, and industrial area (**Figure 1-1**). The onsite area is bounded by Union Boulevard to the south, the Dzus Fastener Company, Inc. facility (which is not part of the NYSDEC Site No. 152033 site; and is therefore, considered offsite) and Beach Street to the west, and Long Island Railroad tracks to the north. Immediately to the east of the Dzus Fasteners Company, Inc. site is Willetts Creek, which flows south into Lake Capri, an 8-acre man-made lake. The Lake Capri shoreline is surrounded by low-lying private residential properties. Lake Capri drains into the tidal portion of Willetts Creek through a culvert located under Montauk Highway (**Figure 1-2**). The tidal portion of Willetts Creek is also lined with private residential properties, most of which contain boat slips. Willetts Creek ultimately flows into Babylon Cove and Great South Bay.

1.3.2 Site History

Dzus Fastener (incorporated in the State of New York under the name Dzus Fastener Company, Inc. in 1936) produced fasteners and springs beginning in 1932. Wastes from metal plating, tumbling, electroplating, chromic acid, anodizing, and special finishing operations consisted of oils, heavy metals, volatile organic compounds (VOCs), and salts. Leaching pools onsite were used for the disposal of hazardous wastes. A Phase I Investigation was completed by NYSDEC

in 1984, and a Phase II Investigation report was submitted by Dzus Fastener Company, Inc. in August of 1990. An Interim Remedial Measure (IRM) was completed by Dzus Fastener Company, Inc. in April/May 1991, during which approximately 1,960 cubic yards (cy) of contaminated soil from the area of the onsite industrial leach field were removed.

Under the State Superfund Program, the NYSDEC initiated an RI/FS in May 1992 to determine the nature and extent of the contamination attributable to the Dzus Fasteners Company, Inc. site and develop an appropriate remedy. During RI activities, several onsite source areas were identified as areas with cadmium contamination. While the 1991 IRM removed some soil, the RI efforts indicated that additional onsite soil that had not been remediated were found to be contaminated with cadmium, chromium(III) or trivalent chromium (hereafter, chromium), and cyanide. Both onsite and offsite groundwater also contained levels of cadmium, chromium, and cyanide, as well as VOCs (primarily trichloroethene, tetrachloroethene, and 1,1,1-trichloroethane) above NYSDEC standards. Surface water and sediment samples were collected from 22 locations in Willetts Creek and Lake Capri. Three surface water locations and most of the sediment samples contained cadmium at concentrations greater than their respective NYSDEC standards. Detailed information regarding actions following the RI is provided in the following sections.

The facility changed its name from Dzus Fastener Company, Inc. to DFCI Solutions, Inc. in 2001, but operations did not change. Operations included the design and manufacture of ¼-turn fasteners, quick-acting latches and panel strips in steel, stainless steel, aluminum, and plastic for use in military and commercial aerospace, transportation, electronics, air handling, refrigeration, motor control, and computer industries to secure access panels, covers, or detachable components. In 2015, DFCI Solutions, Inc. ceased operations and moved all equipment out of the facility. Numerous investigations have been conducted at the site over the years, with cadmium and chromium identified as the primary contaminants of concern (COCs).

1.3.3 Operable Units

The collective Dzus Fasteners Company, Inc. site (onsite and offsite areas) consists of four OUs (**Figure 1-3**). An OU represents a portion of a remedial program for a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

OU1 (**Figure 1-3**) consisted of the onsite leaching pools (the source) and areas of soil contamination at the facility. A ROD was issued for the site by NYSDEC in March 1995. The selected remedy consisted of in situ stabilization/solidification for onsite soil containing cadmium at concentrations greater than 10 ppm. Three areas on the western portion of the facility were excavated and mixed with the soil to be treated on the eastern portion of the facility property. Additional remedial components included design and installation of a final topsoil/asphalt cover at the eastern portion of the facility, which would protect the stabilized area from erosion and implementation of institutional controls, in the form of a deed restriction at the site.

OU2 (**Figure 1-2)** was comprised of the offsite contamination including sediment and water contamination of Willetts Creek and Lake Capri. A ROD was issued for the site by NYSDEC in October 1997. The selected remedy included dredging (the entire lake bottom to a depth of approximately 1 ft), dewatering, and offsite disposal of contaminated sediments from Lake Capri; excavation and offsite disposal of approximately 100 cy of sediment from Willetts Creek, corresponding to levels of cadmium exceeding 9 ppm; and a long-term monitoring program to evaluate the effectiveness of the onsite remedy and to verify that any existing groundwater plume does not impact public health or environment. Subsequent post-remedial monitoring of the wetland sediments in the Willetts Creek area found residual levels of cadmium in sediments that exceeded both the remedial goals established in the OU2 ROD as well as the most recent NYSDEC Sediment Guidance Values (SGV) (NYSDEC 2014).

OU3 encompasses the area of offsite impacted wetlands located behind a strip mall on Union Boulevard and includes a portion of the Willetts Creek channel upstream of Lake Capri. Soil samples for cadmium and chromium analysis were collected from 39 residential properties along Willetts Creek and from 23 locations at Beach Street Middle School. Sampling results showed the potential for direct contact exposure of cadmium and chromium for residents and workers in the area. The OU3 RI was conducted by EA in 2016 to evaluate surface and subsurface soil and sediment. A ROD for OU3 was issued by the NYSDEC in August 2017. The selected remedy includes excavation and offsite disposal of Willetts Creek bank soil that exceed the residential use soil cleanup objectives (SCOs) for cadmium and chromium; removal and offsite disposal of sediment to native material in the portion of Willetts Creek (and floodplain) where cadmium and chromium were observed above the residential SCOs for soil and for sediments above the lowest end of the Class B SGVs; confirmation sampling; and restoration. Approximately 33,000 cubic yards of sediment and soil will be removed as part of the OU3 remedy.

In April and November 2013, additional sediment sampling was conducted in Willetts Creek and Lake Capri to evaluate elevated cadmium concentrations. OU4 was established to fully delineate the extent of cadmium and chromium contamination. OU4 includes the portion of Willetts Creek downstream of OU3, Lake Capri sediment and floodplains, and the tidal area of Willetts Creek downstream of Lake Capri. Lake Capri was previously managed as a component of OU2 but is included as part of OU4 since it was found to be re-contaminated after the OU2 remedy was completed. The Willetts Creek tidal area will be managed as a separate operable unit (OU5).

1.3.4 Property Information

The Dzus Fastener Company, Inc. site, assigned NYSDEC Site No. 152033, is located along Union Boulevard in the city of West Islip, Suffolk County, New York (**Figure 1-1**). The property is an irregular-shaped parcel that is 7 acres in size. The site inclusive of all four operable units (onsite and offsite) is approximately 26 acres. The main access to the Dzus Fastener Company, Inc. site is located along Union Boulevard. The current site boundary consists of a portion of one Suffolk County tax parcel and is in an area of mixed use including residential, industrial, and commercial properties (**Figure 1-4**). Willetts Creek flows through

private residential properties, commercial properties, and school properties before entering Lake Capri just south of Ivy Court. Lake Capri is made up of residential properties with residences along the shore; there is no public access to the lake. Lake Capri drains into the tidal portion of Willetts Creek through a culvert located under Montauk Highway. Private residences also border the tidal portion of Willetts Creek. The tidal portion of Willetts Creek flows into Babylon Cove in Great South Bay, which is separated from the Atlantic Ocean by Fire Island.

1.3.5 Site Geology

The site is in the Atlantic Coastal Plain Physiographic Province. The geology of Long Island is characterized by a southward-thickening wedge of unconsolidated Cretaceous and Cenozoic sediments unconformably overlying a gently dipping Pre-Cambrian bedrock surface. The site is underlain by the Upper Glacial Aquifer. The Upper Glacial Aquifer is an unconfined aquifer approximately 250 to 260 ft thick with 200 to 210 ft of saturated thickness consisting of mostly Pliocene and Pleistocene glacial deposits. The Upper Glacial Aquifer rests unconformably on the Cretaceous Magothy Formation. The water table beneath the site is 0 to approximately 14 ft below ground surface (bgs). Based on historical data, the groundwater flow direction in the Upper Glacial Aquifer is to the south-southwest.

The sediment in Lake Capri is generally characterized by medium to coarse sand and gravel overlain by a shallow layer of fine silt and organic debris. The Willetts Creek tidal area sediments were generally very fine silt with little amounts of clay underlain by fine to medium grain moderately sorted sand with little amounts of gravel and trace pebbles. The sand was usually observed at a depth of 2–3 ft below the sediment surface.

1.3.6 Site Hydrology/Hydrogeology

Lake Capri was formed by impoundment of the Willetts Creek estuary upon construction of the embankment for Montauk Highway (Route 27A), or its predecessor, before the turn of the century. The northwest corner of the lake is characterized as a small, approximately ¼-acre lagoon, fed in part by what is now a relatively short intermittent stream. Except for the fenced south end of the lake that fronts Montauk Highway, Lake Capri is made up of low-lying residential properties. The lake is relatively shallow freshwater lake, with a depth of slightly greater than 3 ft over broad areas. The lake is fed primarily by surface flows from Upper Willetts Creek, by stormwater runoff from two outflow structures that drain local streets to the east and west, and by groundwater.

A concrete outfall structure at the south end of the lake controls overflow into a culvert that extends under Montauk Highway and to Lower Willetts Creek. This tidal portion of Willetts Creek is saline, and the average daily tidal swing is approximately 1 ft. Given the approximately 3 to 4 ft average head drop between Lake Capri and the tidal Lower Willetts Creek, it is likely that the lake also discharges by groundwater flow.

Historical groundwater studies at the site, using calculated gradients and an assumed hydraulic conductivity value of 1 to 10 ft per day, typical for an unconsolidated sandy/gravely aquifer,

lateral groundwater flow in the Upper Glacial Aquifer is expected to average approximately 2.4 to 24 ft per year.

2. SUMMARY OF OU4 REMEDIAL INVESTIGATION AND EXPOSURE ASSESSMENT

The following sections briefly summarize the environmental impacts at OU4 as determined during the RI (EA 2018). Media that were evaluated during the RI included surface and subsurface soil, sediment, and surface water. Using RI results and historical data, cadmium and trivalent chromium were determined to be COCs for OU4.

This section is organized by media of potential concern. The impacts associated with the environmental media are based on analytical results. Results are compared to the appropriate SCGs based on site use:

- ***Soil***—6 New York Code of Rules and Regulations (NYCRR) Part 375 Environmental Remediation Programs – Restricted Use SCOs for Residential Use (NYSDEC 2006).

- ***Sediment***—Screening and Assessment of Contaminated Sediment – Sediment Guidance Values for Class C Freshwater Sediment (NYSDEC 2014).

- ***Surface Water—***New York State Ambient Water Quality Standards and Guidance Values for Class C Water (NYSDEC 1998).

A full analysis of all data collected during the RI is included in the RI Report (EA 2018).

2.1 OU4 FLOODPLAIN SOIL

The focus of the floodplain soil screening and characterization efforts conducted during the RI was to determine the nature and extent of the COCs in floodplain soil adjacent to Lake Capri using a combination of surface (0–2 in.) and subsurface (2–6 in.) sampling to collect soil for laboratory analysis. Floodplain soil was collected from 175 sampling locations (**Figure 2-1**) and analyzed for cadmium, trivalent chromium, and hexavalent chromium. During the OU3 RI, 111 samples were collected but were within the footprint of OU4. An additional 64 residential soil samples were collected during the OU4 RI in December 2017. A subset of 11 floodplain soil samples were analyzed for Target Compound List VOCs. Results of the floodplain surface and subsurface soil samples were used to evaluate the human health and ecological risks from direct contact exposure pathways to site surface and subsurface soil.

Cadmium and chromium were detected in 37 and 167 of the 175 floodplain soil samples collected and submitted for analysis via EPA Method 6010C, respectively (**Figure 2-1**). Concentrations of cadmium were detected in floodplain soil samples with concentrations greater than the SCO for residential use of 2.5 ppm. Detected concentrations of cadmium ranged from 1.4 J to 84 ppm, with 21 of 175 sampling intervals exceeding the SCO for residential use (2.5 ppm). Cadmium concentrations exceeded the residential use SCO at the subsurface interval (deepest interval collected) at locations 152033-OU4-SB-RBBB-01 and 152033-OU4-SB-RQQQ-01.

Detected concentrations of chromium ranged from 5.6 J to 64 ppm, with 12 of 175 sampling intervals exceeding the SCOs for residential use (36 ppm). Chromium concentrations exceeded the residential use SCO at the subsurface interval (deepest interval collected) at locations 152033-OU4-SB-RLLL-01 and 152033-OU4-SB-RXXX-01. All the samples were analyzed for hexavalent chromium to aid in determination of chromium speciation in soil. Hexavalent chromium was not detected in any of the samples submitted for analysis. Therefore, chromium (III) was determined to be the species of chromium associated with the Dzus site. Detections of VOCs were not observed, except for toluene (0.0014 ppm) in one sample.

2.2 OU4 SURFACE WATER

Surface water samples were analyzed for dissolved metals (cadmium and chromium) from 20 locations in Lake Capri to obtain representative surface water conditions. The results were compared to New York State Ambient Water Quality Standards and Guidance Values for Class C Water (NYSDEC 1998)[1]. Neither cadmium nor chromium were detected in any of the surface water samples collected for analysis.

2.3 OU4 SEDIMENT

A sediment investigation was conducted in Willetts Creek on 14 December 2017, and in Lake Capri between 26 February and 3 March 2018, to fill data gaps related to the vertical and horizontal extent of contamination identified during previous sampling activities. **Figures 2-2** and **2-3** shows sediment sample locations.

2.3.1 Willetts Creek

Sediment samples were collected from three transects of the OU4 portion of Willetts Creek. Each transect consisted of three sampling locations: one on each bank, and one in the middle of the channel. Samples were collected from 0–6 in. and 6–12 in. at each location. Cadmium and chromium were each detected in 12 and 14 of the 24 Willetts Creek sediment samples collected and submitted for analysis via EPA Method 6010C, respectively. **Figure 2-2** shows the locations where sediment samples contained cadmium at concentrations exceeding the Class C Freshwater SGV of 5 ppm. Detected concentrations of cadmium ranged from 1.9 to 87 ppm (152033-OU4-SD-WC03E-0612), with 10 of 24 samples exceeding the Class C Freshwater SGV (5 ppm) at all sample depths. Detected concentrations of chromium ranged from 7 to 60 ppm (152033--WC-10). Chromium concentrations in Willetts Creek sediment did not exceed the Class C Freshwater SGV (110 ppm). Hexavalent chromium was not detected in Willetts Creek sediment.

Toxicity testing was also conducted on a subset of sediment samples collected from Willetts Creek. The sediment toxicity testing suggested that the elevated cadmium concentrations in

[1] Hardness was not analyzed in surface water samples; freshwater ecological screening values for cadmium and chromium were not calculated.

Willetts Creek have impacted the test organisms when compared to the control sample. These results suggest that the benthic community is impaired by cadmium contamination.

2.3.2 Lake Capri

Sediment samples in Lake Capri were targeted at depth intervals of 0–6 in., 6–12 in., and 12–24 in. A terminal depth of 24 in. was not achieved at all locations due to refusal of the sampling tool, or loss of coarse grained material from the sampler during retrieval. Cadmium and chromium were detected in 84 of the 122 and 13 of the 122 sediment samples collected and submitted for analysis via EPA Method 6010C, respectively. **Figure 2-3** shows the locations where sediment samples contained cadmium at concentrations exceeding the Class C Freshwater SGV of 5 ppm. Detected concentrations of cadmium ranged from 1.4 to 150 ppm (152033-OU4-SD-LC09-0006), with 64 of the 122 sample intervals exceeding the Class C Freshwater SGV (5 ppm), observed at all sample depth intervals. Detected chromium concentrations ranged from 8.5 to 82 ppm (152033-OU4-SD-LC09-0006), all of which were below the Class C Freshwater SGV for chromium (110 ppm). Hexavalent chromium was not detected in sediment samples collected from Lake Capri. The maximum depth of exceedance for Lake Capri is shown on **Figure 2-4.**

Toxicity testing was also conducted on a subset of sediment samples collected from Lake Capri. The sediment toxicity testing suggested that the elevated cadmium concentrations in Lake Capri have impacted the test organisms when compared to the control sample. These results suggest that the benthic community is impaired by cadmium contamination.

2.4 OU4 BIOLOGICAL TISSUE SAMPLING

The biological tissue sampling program was conducted on 18 and 19 June 2018. Seventeen juvenile bluegills were collected, ranging in size from 50 to 148 millimeters, and ranging in weight from 2 to 65 grams. One pumpkinseed was collected (148 millimeters, 54 grams). Cadmium was detected in all forage fish samples, with concentrations ranging from 0.13 to 0.43 milligrams per kilogram. There was no apparent correlation between body size and cadmium concentration in forage fish samples. Chromium was not detected in forage fish samples.

Ten largemouth bass were collected, ranging in size from 203 to 416 mm, and ranging in weight from 112 to 850 grams. Cadmium was detected in six of the predatory fish samples, with concentrations ranging from 0.010 to 0.033 milligrams per kilogram. The was no apparent correlation between predatory fish body size and cadmium concentration. Chromium was not detected in predatory fish samples.

2.5 HUMAN HEALTH RISK ASSESSMENT

A qualitative assessment of human health exposure pathways for all impacted media was completed using analytical data obtained during the RI. Media evaluated include surface and subsurface soil/fill material, surface water, and sediment. The exposure assessment concluded that surface and subsurface soil/fill and sediment have the potential to impact human receptors.

There are several distinct human populations both within and near OU4 that could potentially be exposed to site-related COCs. Current potential onsite and offsite populations, which may be exposed include commercial workers, adult and child recreationalists, and adult and child residents. Offsite receptors also include adult industrial workers. Due to the nature of OU4, future use scenarios are like current use scenarios. The RI and qualitative human exposure assessment have indicated that there are actual and potential pathways through which populations onsite and offsite could be exposed to potentially hazardous chemicals related to the former operations at the Dzus Fastener Company, Inc. site.

According to the Long Island Region Fish Advisories published by the NYSDOH, women under 50 and children under 15 should not eat any fish from Lake Capri. Men over 50 and women over 15 are advised to not eat more than 1 meal per month of American eel or carp, and not more than 4 meals per month of all other fish. These advisories are based on chlordane and cadmium, the latter associated with the Dzus site.

2.6 ECOLOGICAL RISK ASSESSMENT

To identify actual or potential impacts to fish and wildlife resources from contaminants of ecological concern, a Fish and Wildlife Resources Impact Analysis was conducted as part of the OU4 RI. The exposure assessment concluded that surface and subsurface soil/fill and sediment concentrations of cadmium present a potential exposure pathway to fish and wildlife.

There are no state-regulated freshwater wetlands within OU4. Willetts Creek was identified as a Class C stream, which may be suitable for fishing, fish survival, and primary and secondary recreation, but are often limited by flow or stream substrate. Lake Capri is a Class C freshwater pond.

The ecological communities within the site include a eutrophic pond, urban structure exterior, mowed lawn with trees, mowed lawn, paved and unpaved roads/paths, mowed roadside/pathway, and flower/herb gardens. No signs of stress to vegetation or wildlife resulting from impacts of the site-related COCs were observed during field activities.

The wooded areas associated with Willetts Creek and other isolated areas with vegetation are of significant value to wildlife (such as urbanized bird and some mammalian species). Mobilization of sediments through periodic rain events and snow melt is the primary contaminant migration pathway at the site. Erosion of contaminated fill from the adjacent commercial areas is another potential contaminant migration pathway. The creek habitat and freshwater wetlands located along Willetts Creek are likely of limited value to fish and other aquatic fauna due to the intermittent nature of the creek in this reach. Further downstream; however, the creek is perennial with higher value to fish and aquatic fauna utilizing the riparian habitat and lacustrine habitat associated with Lake Capri. Sediment sampling results from Willetts Creek and Lake Capri indicate that metals have migrated from the Dzus Fastener Company, Inc. site. Therefore, sediment contamination presents a potential exposure pathway to fish and wildlife within the area of the site (OU4).

3. DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

Goals for the OU4 (lower portion of Willetts Creek and Lake Capri) remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375 (NYSDEC 2006). The remedial goal for all remedial actions is the restoration of the site to the pre-disposal/pre-release conditions to the extent practicable and legal. RAOs are defined as the media-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific SCGs (described in Section 2) to address contamination identified at a site. The RAOs for the Dzus Fastener Company, Inc. site are to meet the SCGs listed below.

3.1 CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

The media cleanup goals are based on New York State SCGs for sediment in freshwater (Willetts Creek and Lake Capri) and soil site-specific risk assessment, COCs, site characteristics, and feasible actions. The COCs for soil and sediment at the Dzus Fastener Company, Inc. site identified during the RI are cadmium and trivalent chromium. Cleanup goals can be achieved by either removing the soil and sediment contamination or preventing impacts to human or ecological receptors via reducing ingestion/direct contact with impacted soil.

Soil/Fill – Soil Cleanup Objectives

	Chemical of Potential Concern	Concentration Range Detected (ppm)[1]	SCO[2] (ppm)		
			Unrestricted	Residential	Frequency Exceeding Unrestricted Use SCOs
Inorganics	Cadmium	1.8–47	2.5	2.5	14/100
	Chromium	5.6–130	30	36	9/100

[1] Based on historical data (AECOM) and 2016-2018 Remedial Investigation results.
[2] New York State Department of Environmental Conservation 6 New York Codes of Rules and Regulations Table 375-6.8(a)&(b)

Sediment – Freshwater Sediment Guidance Values

	Chemical of Potential Concern	Concentration Range Detected (ppm)[1]	SGV[2] (ppm)	Frequency Exceeding Lower Limit of Class B SGV[3]
			Class B	
Inorganics	Cadmium	0.82–150	1-5	125/184
	Chromium	7-82	43-110	6/149

Class B: Slightly to moderately contaminated and additional testing is required to evaluate the potential risks to aquatic life.
Class A SGV is <1 ppm and is considered to be of low risk to aquatic life. The frequency exceeding Class A SGV (not shown) is the same as lower limit of Class B.
[1] Based on historical data (AECOM 2016) and 2016-2018 Remedial Investigation results.
[2] New York State Department of Environmental Conservation Technical Guidance for Screening and Assessment of Contaminated Sediment, 2014.
[3]The lower limit of Class B SGV was chosen as the SCG for Freshwater sediment per NYSDEC.

3.2 REMEDIAL ACTION OBJECTIVES

The medium-specific RAOs for the Dzus Fastener Company, Inc. site are provided in the following table.

Soil	Specific RAOs
RAOs for Public Health Protection	• Prevent ingestion/direct contact with contaminated soil. • Prevent inhalation exposure to contaminants through particulates in airborne dust.
RAOs for Environmental Protection	• Prevent migration of contaminants that would result in sediment contamination. • Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Sediment	Specific RAOs
RAOs for Public Health Protection	• Prevent direct contact with contaminated sediments.
RAOs for Environmental Protection	• Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain. • Restore sediments to pre-release/background conditions to the extent feasible.

3.3 EXTENT OF IMPACT TO ENVIRONMENTAL MEDIA

The extent of soil/sediment that exceeded cadmium and chromium SCGs is shown on **Figures 3-1 through 3-2**. The estimated volume of soil/sediment material by area is summarized in the following table.

Total Impacted Environmental Medial

Impacted Media	Soil/Sediment Cleanup Objective	Estimated Volume of Impacted Material	
		Cubic Yards (cy) [a]	Tons
Sediment	Lower limit of Class B[b]	19,000	22,800
	Upper limit of Class B [c]	16,000	19,200
Soil	Unrestricted Use	1,800	2,700
	Restricted Use	1,278	1,917

[a] Due to unclear distinction between sediment and soil for areas with horizontally unbound data, sediment volumes may include some soil, but it is not significant.
[b] Freshwater: Cadmium = 1 ppm and Chromium = 43 ppm
[c] Freshwater: Cadmium = 5 ppm and Chromium = 110 ppm

3.4 POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or relevant and appropriate requirements (ARARs) are local, state, and federal regulations, including environmental laws and regulations that are used in the selection

of remedial alternatives, as well as other non-environmental laws and regulations. The development and evaluation of remedial alternatives presented in Section 6 include a comparison of alternative site remedies to ARARs. The recommended remedial action for this site must satisfy all ARARs unless specific waivers have been granted.

EPA defines "applicable" and "relevant and appropriate" in the revised National Contingency Plan, codified at 40 Code of Federal Regulations (CFR) 300.5 as follows:

- ***Applicable Requirements***—Substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site.

- ***Relevant and Appropriate Requirements***—Standards of control that address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the site.

To determine whether a requirement is relevant and appropriate, characteristics of the remedial action, the hazardous substances present, and the physical characteristics of the site must be compared to those addressed in the statutory or regulatory requirement. In some cases, a requirement may be relevant, but not appropriate. In other cases, only part of a requirement will be considered relevant and appropriate. When it has been determined that a requirement is both relevant and appropriate, the requirement must be complied to the same degree as if it were applicable (EPA 1988).

ARARs for remedial action alternatives at the Dzus Fastener Company, Inc. site can be generally classified into one of the following three functional groups: chemical, action, or location-specific.

To-be-considered materials (e.g., federal/state criteria, advisories, and guidance values) are non-promulgated advisories or guidance issued by federal or state government, which are not legally binding; and therefore, do not have the status of potential ARARs.

Guidance documents or advisories to be considered in determining the necessary level of cleanup for protection of human health or the environment may be used where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to afford protection.

Federal and state requirements for soil, water, and air were considered to determine if they were ARARs, based on site characteristics, site location, and the alternatives considered. The following sections summarize the specific federal, state, and local ARARs for the remedial actions that may be taken at the Dzus Fastener Company, Inc. site, and for the types of technologies that will be developed into remedial alternatives. Cadmium and chromium are the primary COCs identified during the RI. Thus, each of the following ARARs has been chosen for its potential applicability or relevance and appropriateness.

3.4.1 Chemical-Specific Applicable or Relevant and Appropriate Requirements

Chemical-specific requirements are established health- or risk-based numerical values or methodologies that establish cleanup levels or discharge limits in environmental media for specific substances or pollutants. Cleanup standards for impacted soil are defined in 6 NYCRR Part 375 Environmental Remediation Programs with SCOs specified based on current and/or future land use, and the standards for impacted sediments are defined in 2014 Screening and Assessment of Contaminated Sediments (NYSDEC 2014) for Freshwater SGVs.

3.4.2 Action-Specific Applicable or Relevant and Appropriate Requirements

Action-specific ARARs set controls or restrictions on the design, implementation, and performance levels of activities related to the management of hazardous substances, pollutants, or contaminants. The potential action-specific ARARs include:

- ***Air Quality Standards, 6 NYCRR Part 257***—Site activities will follow all substantive requirements of the state air pollution control regulations if air emissions are created.

- ***National Emissions Standards for Hazardous Air Pollutants, 40 CFR Part 61***—Site activities will follow all substantive requirements of the federal air pollution control regulations if hazardous air emissions are created.

- ***New Source Review and Prevention of Significant Deterioration Requirements, 40 CFR Part 50***— Pertains to remediation technologies that emit greater than defined thresholds for listed pollutants.

- ***Solid Waste Management Facilities, 6 NYCRR Part 360***—Provides standards and regulations for permitting and operating solid waste management facilities.

- ***Hazardous Waste Management System: General, 6 NYCRR Part 370***—Provides standards and regulations for the state hazardous waste management system.

- ***Identification and Listing of Hazardous Wastes, 6 NYCRR Part 371***—Provides standards and regulations for the identification and listing of hazardous wastes.

- ***Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities, 6 NYCRR Part 372***—Provides standards, regulations, and guidelines for the manifest system, as well as additional standards for generators, transporters, and facilities.

- ***Water Quality Regulations for Surface Waters and Groundwater, 6 NYCRR Part 700-706—***Provides standards, regulations, and guidelines for the protection of waters within the state.

- ***Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Criteria, 40 CFR Part 261.24***—All waste generated during the removal alternative will be characterized and handled per RCRA regulations, as implemented by WAC 173-303.

- ***Land Disposal Restrictions, 6 NYCRR Part 376***—Pertains to alternatives that require land disposal of hazardous wastes.

3.4.3 Location-Specific Applicable or Relevant and Appropriate Requirements

Location-specific ARARs must be considered when developing alternatives because these types of ARARs may affect or restrict remedial activities. Generally, location-specific requirements serve to protect the individual site characteristics, resources, and specific environmental features. The potential location-specific ARARs include:

- ***Wetlands Protection, 40 CFR Part 6 Appendix A, Section 4***—Provides standards, regulations, and guidelines.

- ***Clean Water Act, 40 CFR Parts 122, 230 and 404/401***—Site activities will be conducted under the National Pollution Discharge Elimination System established permitting requirements, technology-based limitation and standards, control of toxic pollutants, and monitoring of effluents to assure discharge permit conditions and limits are not exceeded. Alternatives that adversely affect an aquatic ecosystem would be avoided to the extent practicable. Discharge of dredged or fill material into navigable waters of the United States would be conducted in accordance with applicable policies, practices, and procedures.

- ***Coastal Zone Consistency, New York State Coastal Management Program***—Site activities will be conducted in accordance with the New York State Coastal Management Program, under which coastal management requirements are outlined. Alternatives that minimize coastal erosion, protect significant fish and wildlife habitats, and protect significant coastal scenic areas and agricultural lands will promoted.

- ***Federal Endangered Species (Section 7) Consultation***—Requires federal agencies to consult with the Fish and Wildlife Service and the fish and wildlife agencies of States, to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species". Alternatives that adversely affect the northern long-eared bat habitat would be avoided to the extent practicable.

- ***The National Historic Preservation Act of 1966 (Section 106) Consultation, 16 U.S.C. 470***—Requires federal agencies to consult with the State Historic Preservation Offices (SHPO) to assess activities which "may directly or indirectly have an effect on historic properties.

- ***New York State Historic Preservation Act of 1980 (Section 14.09) Consultation***—As a state-level counterpart to the National Historic Preservation Act, requires state agencies to consult with the SHPO if "it appears that any projects being planned may or will cause any change, beneficial or adverse, in the quality of any historic, architectural, archeological or cultural property that is listed on the National Register of Historic Places or listed on the State Register or that is determined to be eligible for listing on the State Register." Alternatives with adverse impacts to such property will be avoided or mitigated to the extent practicable.

- ***Fish and Wildlife Coordination Act, 16 USC 662***—Requires federal agencies to consult with the Fish and Wildlife Service and the fish and wildlife agencies of States, where the "waters of any stream or other body of water are proposed to authorized, permitted, or licensed to be impounded, diverted…or otherwise controlled or modified."

- ***Protection of Waters, 6 NYCRR Part 608—***Provides standards, regulations, and guidelines for the protection of waters within the state

- ***Freshwater Wetlands Permitting, Requirements, Classification, and Implementation, 6 NYCRR Parts 662 through 665—***Provides standards, regulations, and guidelines.

- ***Floodplains management Criteria for State Projects, 6 NYCRR Part 502***—Provides standards, regulations, and guidelines.

Additionally, local permits such as land development standards, stormwater and surface water regulations, and clearing and grading requirements may be required depending on the remedial action.

4. GENERAL RESPONSE ACTIONS

In general, remedial technologies fit into one or more category of GRAs. GRAs are generic, medium-specific, remedial actions that will satisfy the RAOs discussed earlier. GRAs may include no action, institutional controls, containment, removal, treatment, disposal, monitoring, or a combination thereof (EPA 1988). The development of remedial alternatives for this FS begins with the identification of GRAs that can meet RAOs. These GRAs are then screened based on their effectiveness, implementability, and cost and developed into remedial alternatives to address impacted media at the site (i.e., soil and sediment). GRAs for soil and sediment at the Dzus Fastener Company, Inc. site are detailed in the following sections.

4.1 SOIL

4.1.1 No Action

The No Action alternative is included for use as the baseline alternative against which other remedial alternatives are compared.

4.1.2 Institutional Controls

Site management (also known as institutional controls) involves the placement of a restriction on the use of property that limits human or environmental exposure, provides notice to any individual who might come in contact with the site, or prevents actions that would interfere with the effectiveness of a remedial program, or with the effectiveness and/or integrity of site management activities at or pertaining to a site.

4.1.3 Containment

Soil and fill containment would be accomplished by installing either a multimedia cap or impermeable liner over the contaminated areas to eliminate exposure and prevent transport through groundwater. The existing physical setting would require consolidation and grading of onsite fill.

4.1.4 Treatment

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. Potentially applicable treatment technologies for soil at this site include in situ biological treatment, in situ soil flushing, in situ stabilization and solidification, and ex situ chemical treatment such as acid leaching and vitrification.

- Biological treatment involves the use of plants to treat the impacted media. This can be achieved through phytoextraction, which involves the physical removal of contaminants from the soil through plant uptake or phytoremediation. It involves contaminant breakdown by the plant or microbes near the root system.

- Soil flushing is the use of water or other suitable aqueous solution to flush contaminants from soil. The fluid is then extracted in situ.

- Stabilization and solidification is achieved using amendments that are mixed into the soil matrix and reduce the toxicity and mobility of the contaminants. This results in the production of a monolith of waste with high structural integrity and can be done in situ or ex situ.

- Acid leaching is the use of acid to remove inorganic contaminants from soil.

- Vitrification is the use of electric current to convert contaminants to an inert, solid form. Following vitrification, the contaminants are trapped within the treated area, eliminating mobility.

4.1.5 Removal

Physical removal of impacted fill would be conducted by excavation, using standard construction equipment (i.e., excavators) to remove material from the ground and load it into transport mechanisms (i.e., trucks) for offsite treatment or disposal.

4.1.6 Disposal

Disposal involves transporting the soil to a landfill. The soil would either be placed in a lined landfill cell or used for daily cover, based on characterization results.

4.2 SEDIMENT

4.2.1 No Action

The No Action alternative is included for use as the baseline alternative against which other remedial alternatives are compared.

4.2.2 Institutional Controls

Site management (also known as institutional controls) involves the placement of a restriction on the use of property that limits human or environmental exposure, provides notice to any individual who might come in contact with the site, or prevents actions that would interfere with the effectiveness of a remedial program, or with the effectiveness and/or integrity of site management activities at or pertaining to a site.

4.2.3 Containment

Sediment containment would be accomplished by installing a cap over the contaminated areas to eliminate exposure. Cap construction could consist of gravel or stone, sand, clay, or plastic that acts as a physical barrier. A reactive cap could also be constructed using sequestering

amendments (bauxite, barite, limestone), biopolymers (chitosan), or other compounds (zeolite, organoclay, apatite) in a thin layer or mixed with sand.

4.2.4 Treatment

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms or immobilize them. Potentially applicable treatment technologies for sediment at this site include in situ or ex situ physical/chemical treatment and in situ biological treatment.

Chemical treatment, such as solidification and stabilization, can be accomplished by the addition of amendments to treat or stabilize the contaminants within the sediment. Stabilization reduces the toxicity and mobility of the contaminants. This results in the production of a monolith of waste with high structural integrity.

Biological treatment involves the use of wetland plants to treat the impacted media. This can be achieved through phytoextraction, which involves the physical removal of contaminants from the sediment through plant uptake or phytoremediation. It involves contaminant break down by the plant or microbes near the root system.

4.2.5 Removal

Physical removal of contaminated sediment from the creek, wetland area, and lake would be conducted by excavation after removing surface water (unless not necessary, for example, creek high banks) or by mechanical or hydraulic dredging with dewatering, using standard dredging equipment, or a combination of both. Removed material would be either treated onsite by setting up a temporary facility for solids processing and/or water treatment systems or loaded into transport mechanisms (i.e., trucks or frac tanks, for offsite treatment or disposal). Amendments would likely need to be used to modify chemical and physical properties of the sediment to facilitate handling and disposal.

4.2.6 Disposal

Disposal involves transporting the sediment to a landfill that will either place the sediment in a lined landfill or use it for daily cover, based on characterization results. Sediment may need to be dewatered, stabilized, or treated prior to transport to meet paint filter test requirements.

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5. IDENTIFICATION AND SCREENING OF TECHNOLOGIES

The potentially applicable technologies identified earlier are screened using the process defined in DER-10, Technical Guidance for Site Investigation and Remediation (NYSDEC 2010). Three preliminary screening criteria (i.e., effectiveness, implementability, and cost) were used to screen the remedial technologies identified earlier for each media of concern.

5.1 SCREENING CRITERIA

5.1.1 Effectiveness

Effectiveness is a measure of the ability of an option to: (1) reduce toxicity, mobility, or volume of contamination, (2) minimize residual risks, (3) afford long-term protection, (4) comply with ARARs, (5) minimize short-term impacts, and (6) achieve protectiveness in a limited duration. Technologies that offer significantly less effectiveness than other proposed technologies may be eliminated from the alternative development process. Options that do not provide adequate protection of human health and the environment likewise may be eliminated from further consideration.

5.1.2 Implementability

Implementability is a measure of the technical feasibility and availability of the option and the administrative feasibility of implementing it (e.g., obtaining permits for offsite activities, rights-of-way, or construction). Options that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period may be eliminated from further consideration.

5.1.3 Cost

Qualitative relative costs for implementing the remedy are considered. Technologies that cost more to implement, but that offer no benefit in effectiveness or implementability over other technologies, may be excluded from the alternative development process.

5.2 SCREENING SUMMARY

5.2.1 Technologies Not Retained for Further Analysis

From the list of technologies potentially applicable for remediation of the COCs and media of concern at this site, a few technologies were excluded from further consideration because they were considered ineffective, not implementable at this site, or too costly relative to the other technologies under consideration (**Tables 5-1A and 5-1B**). The reasons for exclusion are detailed below.

5.2.1.1 Technologies Not Retained for Soil/Fill Material Remediation

An impermeable liner cap (e.g., clay, plastic, etc.) was not retained due to potential

complications with site hydrology associated with its implementation, such as ponding and increased runoff into the adjacent stream. Being on the floodplain, it also has the potential to damage riparian habitat and would result in the loss of ecological services provided by this area. These may also degrade over time and lose long-term effectiveness.

Phytoremediation was not retained because it would require a long timeframe, its effectiveness is limited because of the challenges in plant uptake of metals, and the presence of impacted soil below root zone. In addition, phytoremediation is generally used for lower levels of contamination than what exists at the site and is limited to growing season.

Soil flushing was not retained due to the high relative cost and unknown level of effectiveness. Soil flushing is an emerging technology, which has not been widely implemented.

In situ stabilization was not retained as the technology would cause significant disturbance to the site and does not permanently reduce the volume of hazardous substances. There are also space constraints and other complexities associated with the implementability for this technology for contamination located within flood zone.

Acid leaching and vitrification were not retained due to difficulty of implementation. These technologies also require a long timeframe for implementation with a significantly higher cost than other retained technologies.

5.2.1.2 Technologies Not Retained for Sediment Remediation

Impermeable liner capping was not retained because of its impact on drainage characteristics of the creek and potential to alter site hydrology by reducing infiltration and the stormwater retention capacity of Lake Capri. It would also result in destruction of riparian habitat and loss of ecological services provided by this area.

In situ subaqueous reactive capping was not retained due to uncertainty with long-term effectiveness and moderately high cost.

Phytoremediation was not retained because of the challenges in plant uptake of metals. This technology would require a long timeframe with limited effectiveness. In addition, some impacted sediment is below root zone. In addition, phytoremediation is generally used for lower levels of contamination than what exists at the site and is limited to growing season.

In situ chemical treatment was not retained due to moderately high cost and potential implementability challenges and impacts of adding chemicals to creek ecosystem.

5.2.2 Technologies Retained for Further Analysis

From the list of technologies potentially applicable for remediation of the COCs and media of concern at this site (**Tables 5-1A and 5-1B)**, after eliminating the technologies that were

considered either too expensive, not implementable or ineffective, remaining technologies were retained to develop remedial alternatives.

The technologies retained for both soil and sediment include:

- No action is retained, as set forth in the CERCLA National Contingency Plan, to automatically pass through the screening and be compared with other technologies.
- Institutional controls, that consist of land use restrictions to limit human and environmental exposure, were retained due to is low cost and ease of implementation.
- Thin-layer capping with armor material, such as gravel or stone, was retained for its use as a cap for residuals post sediment removal.
- Multimedia cap (consisting typically of sand, gravel, clay, and stone) was retained for soil and sediment due to the relative ease of implementation and moderate cost.
- Hydraulic dredging of sediment was retained due to high water table, better handling of highly organic and silty soft sediment, and limited access issue.
- Mechanical dredging of sediment was retained because mechanical methods are more capable of removing and handling wood materials and debris, removing sediments at nearly in situ density, and require less dewatering than hydraulic dredging.
- Excavation of soil and sediment was retained, despite the high cost, due to the ability to remove large volumes of contamination from the site in a short period.
- Ex situ stabilization/solidification and offsite disposal of soil and sediment was retained as it is relatively easy to implement and decreases water content. Additionally, it may be required for excavation options to meet RAOs.

5.2.3 Overview of Remedial Alternatives

The following remedial alternatives are considered in this FS for OU4:

- ***Alternative 1***—No Action
- ***Alternative 2***—Site Management
- ***Alternative 3—***Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV
- ***Alternative 4***—Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment

to Class A SGV

- ***Alternative 5***—Excavation with Capping of Soil and Sediment.

6. SCOPING AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

EA performed the alternative comparison in accordance with DER-10 (NYSDEC 2010) and the EPA publication *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA l540lG-891004) (EPA 1988). The screening of alternatives was designed to provide a basis for an overall assessment of applicable technologies based on impacted media identified at the site and related areas during the RI (EA 2018).

The scoping and development of the technologies/alternatives presented in Section 5.0 of the FS are described below.

The extent and volume of soil/sediment requiring remediation was determined based on data collected during the RI as well as historical data, where applicable. In areas where soil or sediment contamination is not horizontally delineated, limits extended outside of the known contamination, **Figures 6-1A, 6-1B, 6-2A, 6-2B, 6-3A, and 6-3B.** A 3 to 6- inch (in.) overdredge was added to address vertically unbound data as well as to provide a more conservative volume estimate. A pre-design investigation is needed to delineate the horizontal and vertical extents of contamination and determine the final impacted area limits.

As OU4 includes a creek and pond with floodplain area, special considerations are required for safe conveyance of base and flood flow within the creek, as well as the ecological impacts to the site. Alternatives must be able to work with or resist the geomorphic processes active within the riparian corridor to prevent exposure, suspension, and transport of contaminated materials.

Detailed alternatives screening is presented in **Table 6-1**.

6.1 ALTERNATIVE 1: NO ACTION

The No Action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the area in its present condition.

6.2 ALTERNATIVE 2: SITE MANAGEMENT

Alternative 2, the second remediation alternative under consideration is to place an institutional control in the form of an environmental easement on the property to control the use of the site. This alternative would leave the contaminants in place but would address the RAO to prevent ingestion/direct contact with contaminated soil/sediment through the installation of a fence with locked gates to control access. Additionally, warning signage would be posted.

6.3 ALTERNATIVE 3: EXCAVATION OF SOIL TO UNRESTRICTED USE SCOS, REMOVAL OF SEDIMENT IN WILLETTS CREEK TO NATIVE MATERIAL, AND REMOVAL OF SEDIMENT IN LAKE CAPRI TO LOWER LIMIT OF CLASS B.

The third potential alternative evaluated is removal of soil and sediment and offsite disposal at an authorized facility. This alternative is aimed at removing soil that exceeds the unrestricted use SCOs (for private residences and school properties) for cadmium and chromium, removing sediment in Willetts Creek to native material, and removing sediment in Lake Capri to lower limit of Class B SGV in the zone of impact. The zone of impact is the portion of lower reach of Willetts Creek and Lake Capri (and associated floodplain), where cadmium and chromium were observed above unrestricted use SCOs for soil and for sediment above the lowest end of the Class B SGVs; an indication of potential for moderate ecological impact. This zone extends from CR36 **(**as shown in **Figure 6-1A)**, the transect of Willetts Creek near the parking lot of West Islip High School (approximately 700 linear ft of creek bed) and covers Lake Capri (**Figure 6-1B**). Target dredge depth to native material for Willetts Creek is the hard bottom of medium to coarse sand and gravel. This alternative includes confirmation sampling to verify that soil exceeding unrestricted use SCOs for soil and for sediment (only for Lake Capri) exceeding lower limit of Class B have been removed.

Excavation and dredging are commonly used to remove contaminated soil and sediment impacted by contaminants from a source area. While soil removal is generally performed by excavation, sediment removal can be performed by dry excavation or dredging or a combination of both. Dry excavation is performed by damming an area, using conventional pumping and dewatering techniques, or diverting water and removing the now exposed sediment surface with an excavator and loading it onto trucks. Dredging is performed by removing submerged contaminated sediments from a waterbody by hydraulic or mechanical methods. These approaches can be effective at eliminating exposure and preventing transport of contaminants. The soil in the floodplains would be removed with an excavator. For cost estimation purposes and due to limited site access, it is assumed that Lake Capri would be dredged hydraulically, and Willetts Creek would be excavated mechanically. Actual implementation of this remedy would not be limited by the methods and systems described below.

The areas of soil removal would be restored with backfill in the residential area. The areas of sediment removal would be restored with backfill, residual cover, and plantings to establish a stable riparian corridor with stable stream, lake, and floodplain. Ex situ physical/chemical amendment (e.g., Portland cement) would be used to help facilitate handling and offsite disposal of contaminated material by reducing free liquids and mobility of contaminants.

Alternative 3 would be implemented as follows:

- Pre-design investigation to refine excavation/dredging boundaries. A detailed 1-ft contour topographic and bathymetric survey would be collected to document the existing conditions of Lake Capri and Willetts Creek corridor, including limits of wetlands and waterways, trees, utilities, top of sediment within the creek and lake, features in the

surrounding area and other relevant existing conditions. The delineation will be used to obtain any necessary permits and authorizations for wetland disturbance/mitigation as required by the United States Army Corps of Engineers. Additional data, such as sediment-probing surveys, historical post-dredging surveys, geotechnical data, bulkhead/shoreline stability evaluation, and treatability studies would be collected to further refine volume estimates and to establish pre-existing conditions before implementing remedial action.

- Coordination would be required with United States Coast Guard and United States Army Corps of Engineers. Coordination would also be necessary for access agreements and associated permits.

- A utility locator would be brought onsite prior to the remedial design process of this alternative to locate known underground utilities or other obstructions that may prove problematic during excavation and dredging activities. This information would be utilized to either re-route these utilities outside the remediation area or to accommodate their locations and future anticipated maintenance.

- Clearing, chipping, and grubbing of woody material and subgrade preparation of the site would be conducted.

- Construction and operation of temporary facilities for sediment processing and water treatment consisting of screens, hydrocyclones, slurry holding tank, recessed plate, and frame filter presses, and stockpiling areas for sediment processing; water treatment plant capable of treating filtrate to New York State Permit Discharge Elimination System (SPDES) discharge criteria. This will require permits and approval from federal, state, and local agencies.

- Stream maybe diverted by pipe diversion of base flow with storm capacity of Willetts Creek. Dewatering and maintenance of flow measures to create a stable work area where necessary, especially when excavating below the water table. Water generated during remediation activities would be treated at the onsite water treatment plant to discharge upon meeting SPDES discharge criteria.

- Installation of turbidity curtains and water quality monitoring would be performed for water quality alert and management. Removal of debris from areas to be dredged would also be performed.

- Approximately 19,000 cy of contaminated sediment and 1,800 cy of contaminated soil covering 9.5 acres averaging a depth of approximately 1 ft would be removed from the area to the maximum extent practicable. The volume currently includes 18 percent contingency for soil and 3 in. overdredge for sediment. Excavated soil and sediment from residential areas and Willetts Creek and associated floodplain would be transported offsite for disposal. Hydraulically dredged slurry from Lake Capri would be conveyed

through a pipeline to the temporary treatment facility on the West Islip High School parking lot. The treatment would include separation, testing, and proper disposal of solids from hydraulic dredge slurry and excavated material through the period of sediment removal. Following dewatering via filter press or gravity dewatering at the onsite solids treatment area, soil will be stabilized using Portland cement or a similar product to meet paint filter test requirements. Once treated and stabilized, material would be transported offsite for disposal. For cost estimation purposes, 5 percent and 95 percent was assumed to be hazardous and non-hazardous waste respectively for hydraulically dredged sediment. Similarly, 5 percent and 95 percent was assumed to be hazardous and non-hazardous waste respectively for excavated soil and sediment.

Technology	Location	Volume (cy)	Tons
Excavation	Willetts Creek and Residential areas	4,298	6,447
Hydraulic Dredging	Lake Capri	16,502	19,802

Total	Location	Volume (cy)	Tons
Sediment	Willetts Creek and Lake Capri	19,000	23,549
Soil	Residential Areas	1,800	2,700

Confirmation samples will be collected following soil removal and sediment removal (only in Lake Capri). Samples will be analyzed for cadmium and chromium.

When sediment in Willetts Creek have been removed to native material and confirmation sample analytical results indicate all sediment in Lake Capri containing cadmium and chromium exceeding lower limit of Class B SGV and all soil containing cadmium and chromium exceeding unrestricted use SCOs have been removed, the site would be restored with the following:

- Clean fill from an offsite source meeting the requirements of 6 NYCRR Part 375-6.7(d) would be used to achieve appropriate grades to restore stream, lake, and wetland functions including new stream channel, riffles, pools, and grade controls, and enable re-vegetation and stabilization. Grade control structures may be necessary in certain location to prevent scour and erosion to the replaced soil materials.

- The excavated and disturbed area within the Creek would be stabilized with an appropriate wetland and riparian seed mix and topsoil for growing medium. It is recommended that any vegetative community established be in accordance with the native ecology present in similar systems.

- Clean fill from an offsite source meeting the requirements of 6 NYCRR Part 375-6.7(d) would be brought in to replace the excavated soil and establish the designed grades at the upland properties; properties would be restored with top soil and grass seed.

- Monitoring as part of the Dzus Site Management Plan to assure the restoration is successful and the remedy remains protective.

6.4 ALTERNATIVE 4: EXCAVATION OF SOIL TO UNRESTRICTED USE SCOS AND REMOVAL OF SEDIMENT TO CLASS A SGV

The fourth potential remediation alternative evaluated is excavation of soil that exceeds the unrestricted use-based SCO (for private residences and school properties) and removal of sediment that exceeds Class A SGV for cadmium and chromium and offsite disposal at an authorized facility.

Alternative 4 would be implemented in the same way as Alternative 3, with differences for handling of soil/sediment highlighted below:

- Approximately 21,432 cy of contaminated sediment and 2,336 cy of contaminated soil covering 9.5 acres averaging a depth of 1.5 ft would be excavated from the site. The volume includes a universal 6-in. overcut or over dredge. For cost estimation purposes, 5 percent and 95 percent was assumed to be hazardous and non-hazardous waste respectively for dredged sediment. Similarly, 5 percent and 95 percent was assumed to be hazardous and non-hazardous waste respectively for excavated soil and sediment. Soil and sediment would be handled and disposed of in the same way as Alternative 3.

Technology	Location	Volume (cy)	Tons
Excavation	Willetts Creek and Residential areas	5,191	7,787
Hydraulic Dredging	Lake Capri	18,577	22,292

Total	Location	Volume (cy)	Tons
Sediment	Willetts Creek and Lake Capri	21,432	26,575
Soil	Residential Areas	2,336	3,504

- Confirmation samples will be collected following soil and sediment removal. Samples will be analyzed for cadmium and chromium.

When confirmation sample analytical results for all sediment and soil indicate all sediment containing cadmium and chromium exceeding Class A SGV and all soil containing cadmium and chromium exceeding unrestricted use SCOs have been removed, the site would be restored in the same way as Alternative 3.

6.5 ALTERNATIVE 5: EXCAVATION WITH CAPPING OF SOIL AND SEDIMENT

The fifth potential remediation alternative evaluated is capping of impacted soil and sediment. Capping provides a physical barrier to contain the contaminated media to reduce potential exposures. In this alternative, contaminated soil and sediment exceeding lower limit of Class B and residential use SCO would be covered by clean sand, soil, cobble, gravel, top soil, and/or

organic matter to recreate a floodplain surface, creek, and lake system. A clean backfill of 1.5 ft meeting residential SCO and a 6-in. top soil would be used to cap contaminated soil. For submerged sediment capping, bench scale testing would be performed to select subaqueous capping materials and demonstrate effectiveness. Capping materials would be placed mechanically over the existing sediment surface, using construction equipment. A multimedia cap effectively addresses RAOs and is effective in long-term source control unless inorganics are soluble and upwelling is substantial. In the case of significant upwelling of groundwater, an alternative material (reactive cap) might be needed to minimize movement of contaminants upward through the cap. Installation of a cap in residential areas will require 2 ft of excavation. Post-excavation samples would be used to determine if capping is needed.

For Alternative 5, contamination will remain in place; and therefore, this alternative depends on agreement with property owners to allow access for the continued monitoring of the remaining contamination, modification of the Dzus Site Management Plan, and the implementation of Deed Restrictions on private property. Since the creek profile cannot be raised, capping will require excavation of 1.5 ft of contaminated sediment from the creek. This approach will remove contamination in areas with shallow contamination, which is a significant portion of the creek, and consequently will not require capping for those areas; however, backfill will need to be used to return the creek bed to its original contours. For Lake Capri, limited excavation will be performed to remove 1 ft of contaminated material from areas with shallow water depth (approximately 2 ft), mostly along the shoreline, prior to excavation. The excavated sediment will be deposited in areas of the lake with depths greater than or equal to 3ft prior to placement of a 1-ft cap across the entire lake.

Alternative 5 will be implemented in the same way as Alternatives 3 and 4, with differences highlighted below. Volume assumptions below include a universal 6-in. overcut or over dredge:

- Need additional studies, such as modeling of scour and erosion resistance to get approval for a cap design.

- Approximately 2,657 cy of contaminated sediment and 2,566 cy of contaminated soil will be excavated from the Willetts Creek and residential areas, and approximately 4,941 cy of contaminated sediment from limited portion (approximately 10–15 ft from the shore) of Lake Capri to allow for cap placement without altering the site bathymetry and topography. The lake water level would need to be lowered (by removing weir boards to the lake outfall) to allow mechanical excavation in targeted shoreline areas. Excavated sediment and soil would be stockpiled at the staging area (potentially parking lot of West Islip High School) for gravity dewatering and amended using Portland cement or a similar product to meet paint filter test requirements. For cost estimation purposes, 5 percent and 95 percent was assumed to be hazardous and non-hazardous waste respectively for excavated soil and sediment.

Technology	Location	Volume (cy)	Tons
Excavation	Willetts Creek, Lake Capri, and Residential areas	10,164	13,764

Total	Location	Volume (cy)	Tons
Sediment	Willetts Creek and Lake Capri	7,598	9,915
Soil	Residential Areas	2,566	3,849

- Areas with soil contamination would be capped with clean common fill material and 6 in. of top soil. The residential areas would have 18 in. of common fill. The cap would be underlain by a protective layer of geotextile, to define the lower limit of the cap in the event of any future excavation in the area. This geotextile underlayment is typically non-woven geotextile and is orange in color to serve as a warning of the contaminated materials below.

- Multimedia capping would be installed with surface materials and contours conforming to the restored condition of remediation area ensuring the long-term stability of the multimedia cap. The cap would be underlain by a protective layer of geotextile, to define the lower limit of the cap in the event of any future excavation in the area.

Once excavation and/or dredging and cap placement are completed, the site would be restored with the following:

- The site would be stabilized with an appropriate wetland and riparian seed mix to stabilize the capped and excavated areas. Topsoil amendment may be necessary. It is recommended that any vegetative community established be in accordance with the native ecology.

- Additionally, the creation of an emergent or scrub-shrub system would decrease the likelihood of the establishment of large trees, which through flood flows, wind or other natural processes could uproot, damaging the multimedia capping system and risking exposure of contaminated sediments beneath.

Following completion, the cap would be inspected semi-annually for the first 5 years and annually thereafter. The cap inspection would serve to monitor effectiveness of the cap and identify any areas requiring repair.

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7. COSTING AND EVALUATION CRITERIA

7.1 COST ASSUMPTIONS

Cost assumptions were prepared for each alternative using EPA's *Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000). Net present value of the project costs was estimated using an interest rate of 5 percent. The cost assumptions were calculated using the most common products, and application methods available for a remedial alternative. The EPA guidance was used in conjunction with *DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010).

Cost estimates were prepared for each alternative based on the assumptions detailed in Section 6. **Appendix A** shows the detailed cost estimates developed. A summary of the costs for all alternatives is provided in **Table 7-1**.

7.2 CRITERIA USED FOR ANALYSIS OF ALTERNATIVES

The criteria to which potential remedial alternatives are compared (and used during this detailed analysis) are defined in 6 NYCRR Part 375 (NYSDEC 2006) and are listed below:

- Overall protectiveness of public health and the environment
- Conformance to SCGs
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume of contamination through treatment
- Short-term impacts and effectiveness
- Implementability
- Cost-effectiveness
- Land use
- Community acceptance.

A description of the criteria and how alternatives are evaluated against them follows.

Overall Protectiveness of Public Health and the Environment—This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Conformance to SCG—Compliance with SCGs addresses whether a remedy would meet environmental laws, regulations, and other standards and criteria. The SCGs were presented in Section 3.

Long-Term Effectiveness and Permanence—This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain onsite after the recommended remedy has been implemented, the following items are evaluated: (1) magnitude of the remaining risks, (2) adequacy of the engineering and/or institutional controls intended to limit the risk, and (3) reliability of these controls.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment—The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances including the adequacy of the alternative in destroying the hazardous substances, reduction or elimination of hazardous substance releases and sources of releases, degree of irreversibility of waste treatment process, and characteristics and quantity of treatment residuals generated. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

Short-Term Impacts and Effectiveness—Evaluation of the short-term effectiveness for an alternative includes consideration of the risk to human health, and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Impacts from remedial action implementation include vehicle traffic, temporary relocation of residences/buildings, temporary closure of public facilities, odor, open excavations; and noise, dust, and safety concerns associated with extensive heavy equipment activity. The greatest short-term risk to human health is related to safety and general construction activity.

Implementability—The technical and administrative feasibility of implementing each alternative is evaluated. Technical feasibility includes the difficulties associated with construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Cost-Effectiveness—Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

Land Use—The current and anticipated future use of the site will be considered. Land use must comply with applicable zoning laws and maps.

Community Acceptance—Public comments will be considered after the close of the public comment period.

8. DETAILED ANALYSIS OF ALTERNATIVES AND RECOMMENDATIONS

The purpose of this FS is to develop, screen, and evaluate potential remedial alternatives for the Dzus Fastener Company, Inc. site. Remedies were identified and screened in accordance with EPA (1988, 2000) and NYSDEC (1998, 2006, 2010) guidance. The comparison of alternatives and recommendations are described below and summarized in **Table 8-1**.

The following remedial alternatives are considered for this FS:

- ***Alternative 1*** —No Action
- ***Alternative 2***—Site Management
- ***Alternative 3***— Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment in Willetts Creek to Native Material and Removal of Sediment in Lake Capri to lower limit of Class B SGV
- ***Alternative 4***— Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV with Offsite Disposal
- ***Alternative 5***—Excavation with Capping of Soil and Sediment

8.1 COMPARISON OF ONSITE AREA ALTERNATIVES

8.1.1 Overall Protection of Public Health and the Environment

This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Alternative 1 does not fulfill this criterion. Alternative 2 moderately fulfills this criterion by protecting public health by the implementation of institutional and engineering controls. Alternative 3 and 4 fulfill this criterion by removing the contaminants exceeding applicable SCGs. Alternative 5 fulfills this criterion by closing off the soil/sediment exposure pathway; and thereby, preventing human contact with remaining contamination.

8.1.2 Standards, Criteria, and Guidance

Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria.

Alternatives 1 and 2 do not meet this criterion. Alternatives 3 meets this criterion by removing soil exceeding unrestricted use SCOs and sediment exceeding lower limit of Class B SGV. Alternative 4 meets this criterion by removing soil exceeding unrestricted use SCOs and sediment exceeding Class A SGV. Alternative 5 meets this criterion by containing the contaminated soil/sediment under the cap.

8.1.3 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If fill or treated residuals remain onsite after the recommended remedy has been implemented, the following items are evaluated: (1) the magnitude of the remaining risks, (2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and (3) the reliability of these controls.

Alternative 1 will not provide long-term effectiveness or permanence. Alternative 2 will not provide long-term effectiveness as a stand-alone alternative. Alternatives 3 and 4 will fulfill this criterion because contaminants at concentrations exceeding respective SCGs would be permanently removed from the site. Alternative 5 will fulfill this criterion but would require long-term maintenance of cap and monitoring as the impacted soil/sediment would remain on site.

8.1.4 Reduction of Toxicity, Mobility, or Volume of Contamination

Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility, or volume of contamination at the site.

Alternatives 1 and 2 will not reduce the toxicity, mobility, or volume of contamination. Alternatives 3 and 4 will fulfill this criterion by removal of contamination exceeding respective SCGs. Alternative 5 will fulfill this criterion by modest removal and containment of contaminated soil/sediment.

8.1.5 Short-Term Impacts and Effectiveness

This criterion evaluates the potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

Alternatives 1 and 2 do not pose additional risk to the community, workers, or environment, as there are no construction activities involved. The remaining alternatives pose increased short-term risks to the public during excavation, dredging, grading, treatment, and other site activities through the generation of dust and water quality impacts at point of dredging; these effects can be reduced through the implementation of standard dust mitigation construction practices. Workers can risk falling off the deck of a barge or can potentially be exposed to contaminated media during excavation and/or treatment activities involved. Risks can be minimized by implementing health and safety controls including the use of appropriate personal protective equipment. These alternatives will pose increased short-term risks to the environment in the form of air emissions.

8.1.6 Implementability

This criterion evaluates the technical and administrative feasibility of implementing each alternative. All alternatives are implementable and have been used nationally. Implementing Alternatives 2–5 will present challenges due to proximity of schools and residences. The proposed locations for temporary treatment facilities for Alternatives 2, 3, 4, and 5 assumes access agreements.

8.1.7 Cost-Effectiveness

This criterion evaluates estimated capital costs, as well as annual operation, maintenance, and monitoring costs, on a present-worth basis.

Alternative 1 is the least expensive but is also the least effective. Alternative 2 is very low in cost and effectiveness. Alternative 4 is the most expensive but is also the most effective. Alternative 3 is more expensive than Alternative 5 but is also more effective.

8.1.8 Land Use

Alternative 1 and 2 would require an environmental deed restriction limiting future use of the site since contamination would remain. Alternatives 3 and 4 involve the removal of soil exceeding unrestricted use SCOs for cadmium and chromium. Under Alternative 5, some of the impacted media would remain onsite, so the land use would be restricted.

8.1.9 Community Acceptance

This criterion evaluates concerns of the community regarding the investigation and the evaluation of alternatives. The Dzus Fastener Company, Inc. site remedial approach has not been presented to the community for comment at the time of this report.

8.2 PREFERRED REMEDIAL ALTERNATIVE FOR THE DZUS FASTENER COMPANY, INC. SITE

Alternative 3 is recommended because the capital cost is moderately high, and the remedial approach removes soil exceeding unrestricted use SCOs and removes sediment posing low to high risks with highest reduction of toxicity, mobility and volume of contamination.

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9. REFERENCES

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Figures

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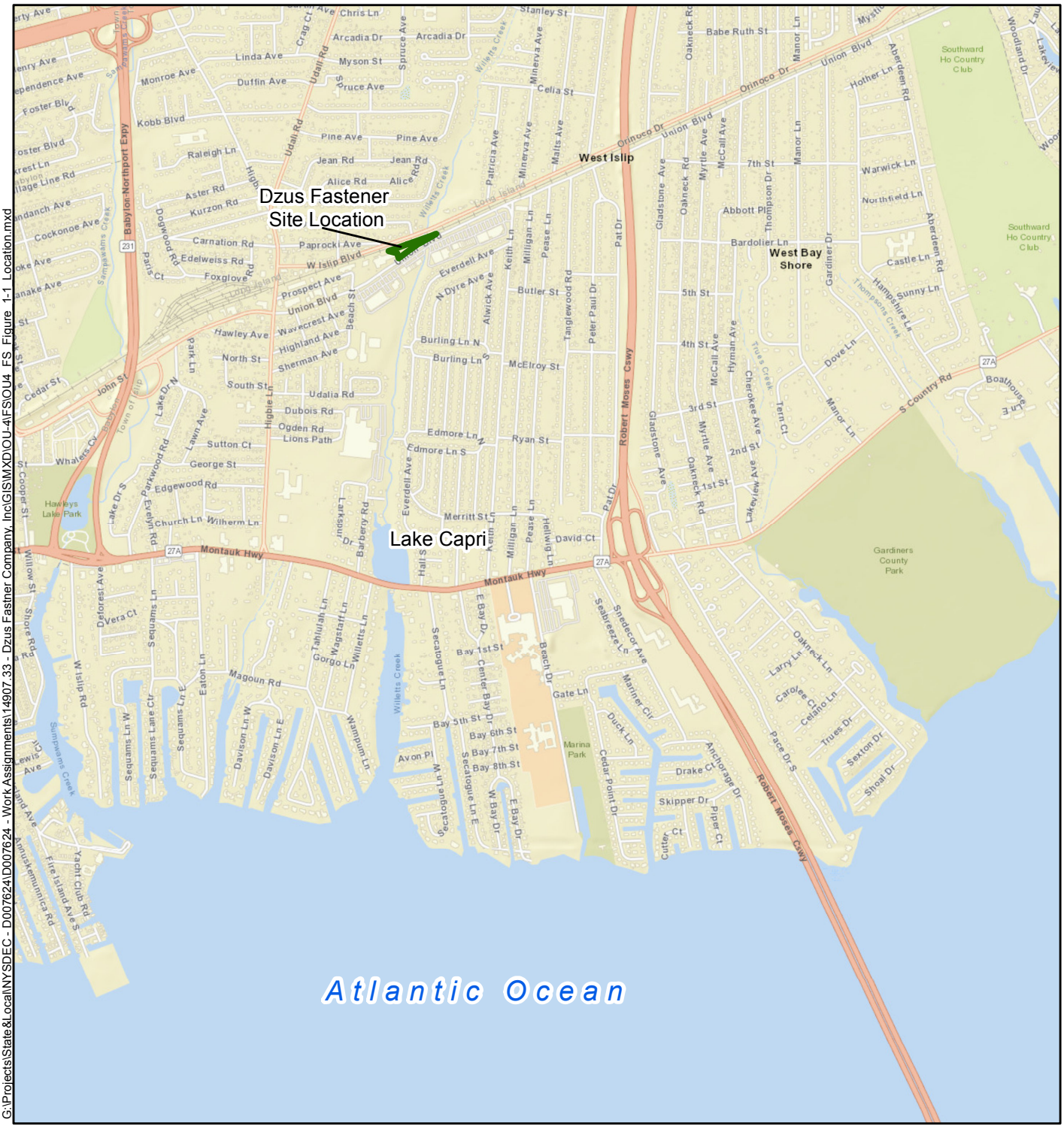

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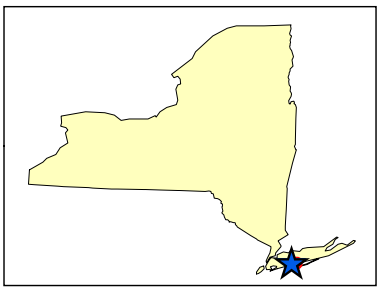

0 0.15 0.3 0.6
Miles

1 inch = 0.386 miles

N

Legend

Dzus Fastener Company, Inc.
Property Boundary

Figure 1 -1
General Site Location
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/7/2018
Projection: NAD83 State Plane New York Long Island

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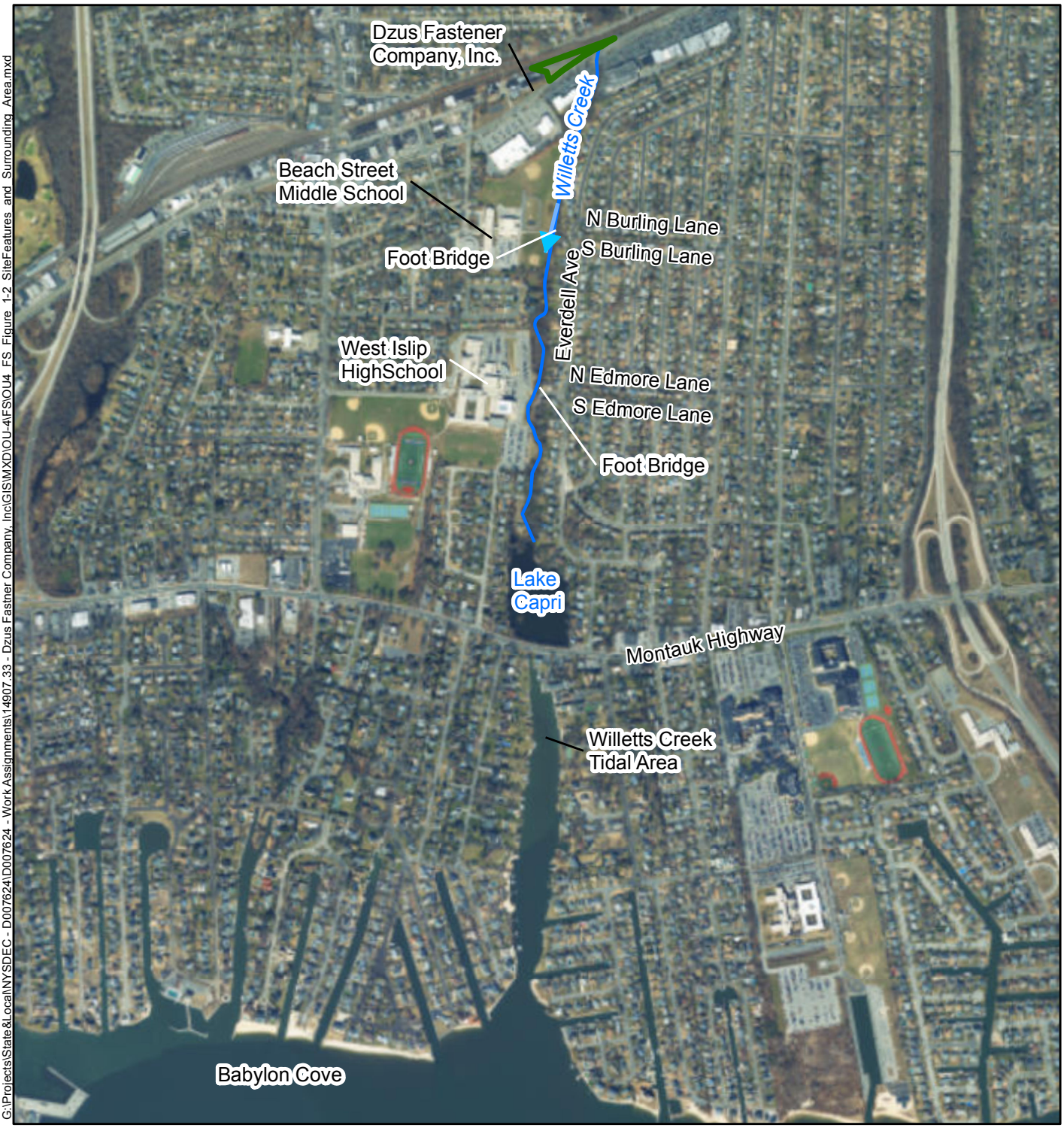
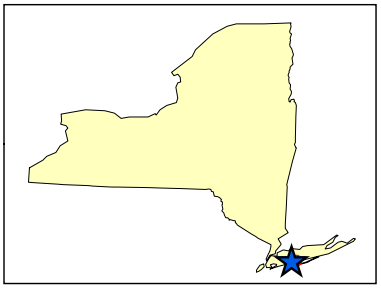


G:\Projects\State&Local\NYSDEC - D007624\D007624 - Work Assignments\14907.33 - Dzus Fastner Company, Inc\GIS\MXD\OU-4\FS\OU4 FS Figure 1-2 SiteFeatures and Surrounding Area.mxd



0 400 800 1,600
Feet

1 inch = 1,175 feet

N

Legend

Willletts Creek

Figure 1-2
Site Features and Surrounding Area
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/7/2018
Projection: NAD83 State Plane New York Long Island

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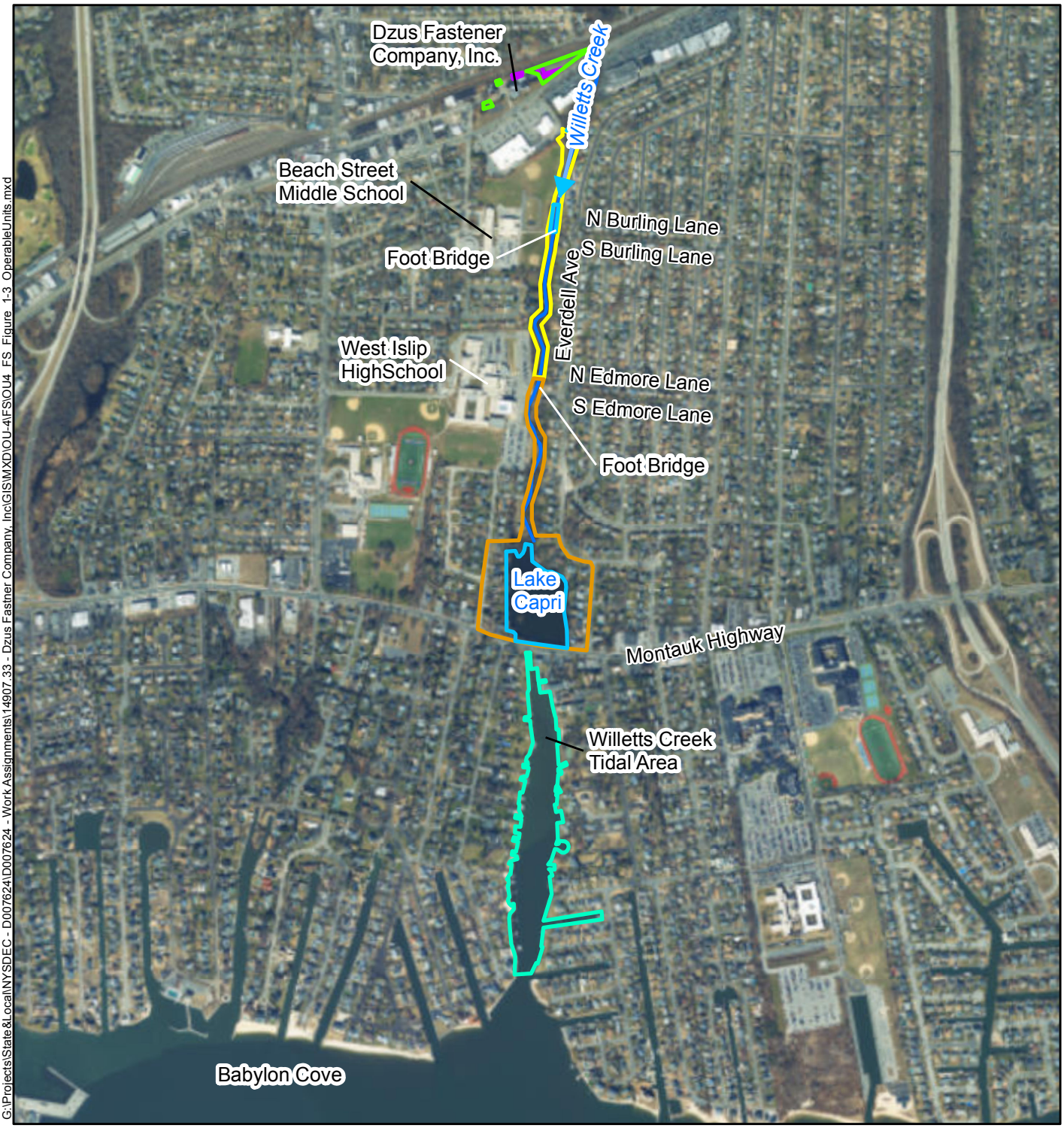
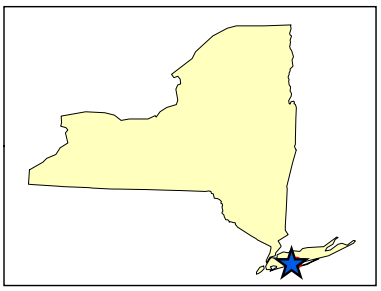


G:\Projects\State&Local\NYSDEC - D007624\D007624 - Work Assignments\14907.33 - Dzus Fastner Company, Inc\GIS\MXD\OU-4\FS\OU4 FS Figure 1-3 OperableUnits.mxd



0 600 1,200
Feet

1 inch = 1,175 feet

N

Legend

- Willletts Creek
- Approximate OU Boundary
- Operable Unit 1
- Operable Unit 1A
- Operable Unit 2
- Operable Unit 3
- Operable Unit 4
- Operable Unit 5

Figure 1-3
Operable Units
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 9/12/2018
Projection: NAD83 State Plane New York Long Island

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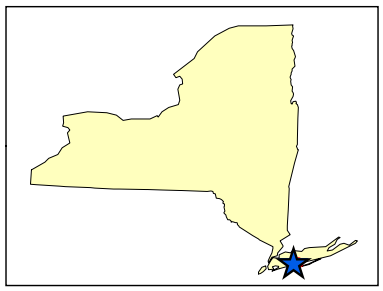

0 500 1,000
Feet

1 inch = 650 feet

N

Legend

- Tax Parcel Boundary
- Willletts Creek

Figure 1-4
Suffolk County
Tax Parcel Identification
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/7/2018
Projection: NAD83 State Plane New York Long Island

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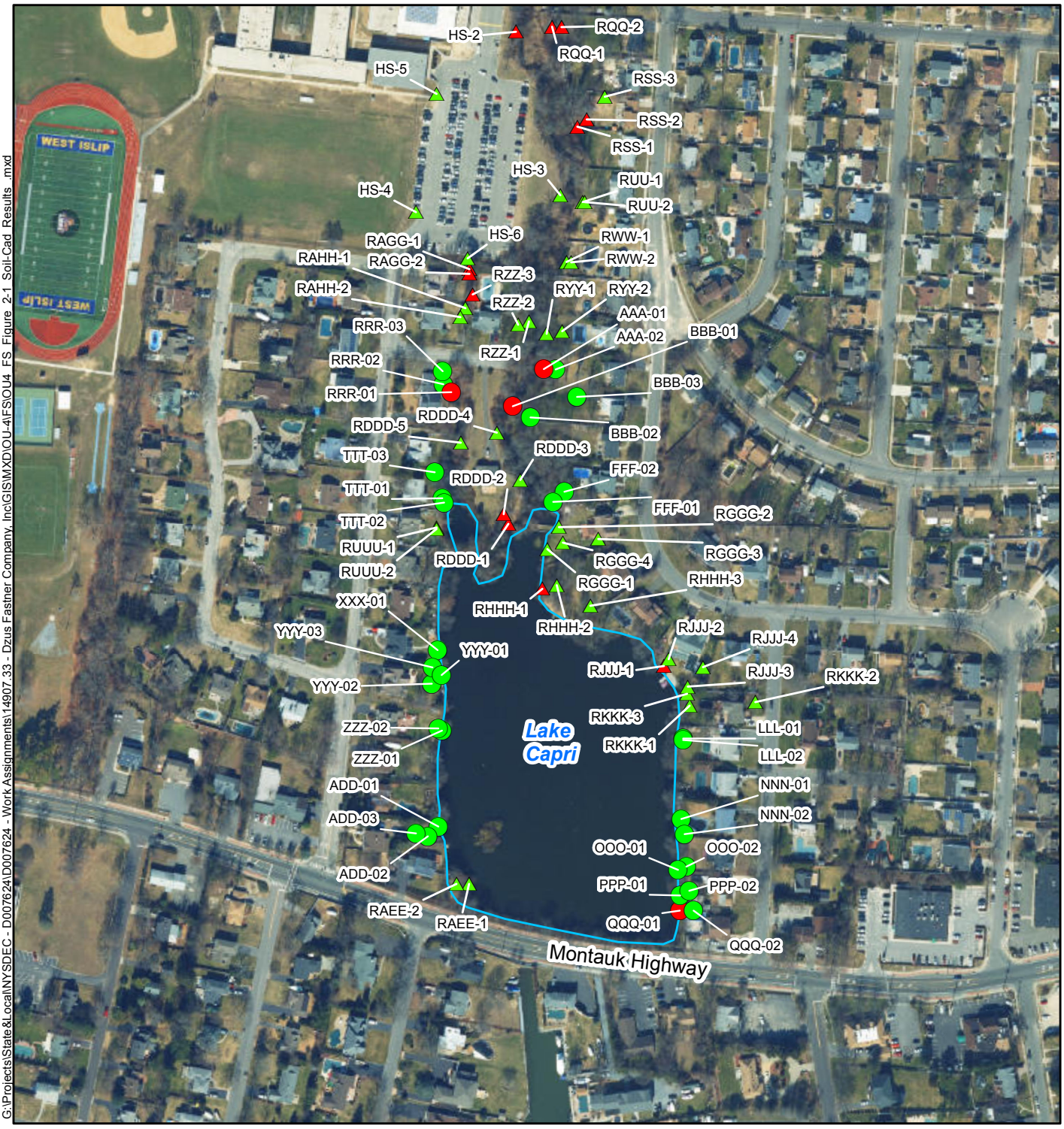
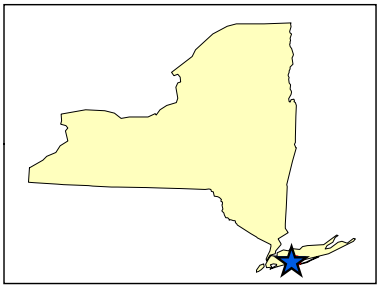


G:\Projects\State&Local\NYSDEC - D007624\D007624 - Work Assignments\14907.33 - Dzus Fastner Company, Inc\GIS\MXD\OU-4\FS\OU4 FS Figure 2-1 Soil-Cad Results .mxd



0 125 250
Feet

1 in = 300 ft

N

Legend

OU4 Sample Results

- Less than Residential SCO
- Greater than Residential SCO

OU3 Sample Results

- Less than Residential SCO
- Greater than Residential SCO

Note: SCO = Soil Cleanup Objective as determined by applicable land use and Table 375-6.8(B) of 6 NYCRR Part 375.

SCO for Residential = 2.5 milligrams per kilogram

Figure 2-1
Operable Unit 4 Cadmium Exceedances in Floodplain Soil

Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/3/2018
Projection: NAD83 State Plane New York Long Island

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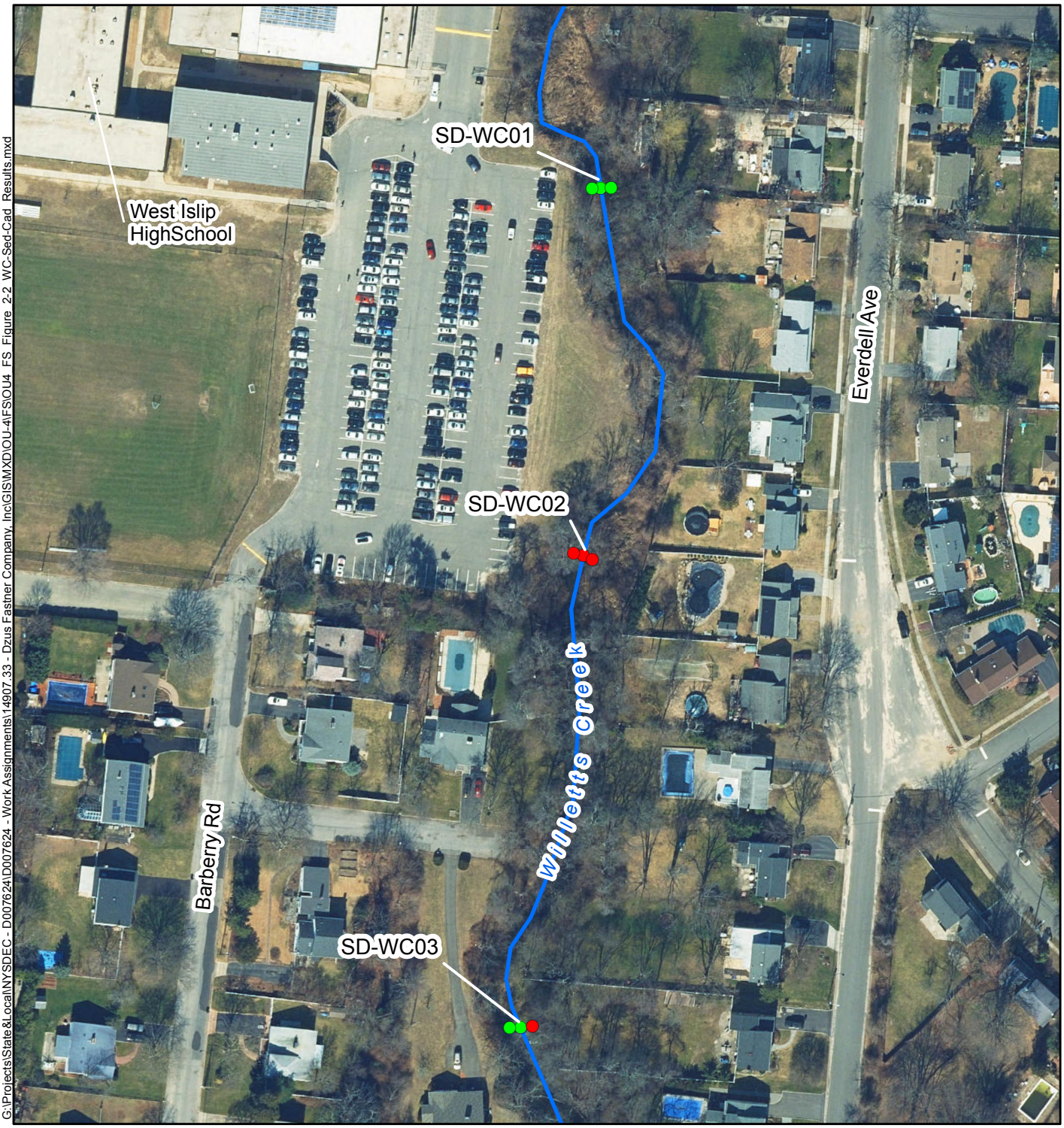

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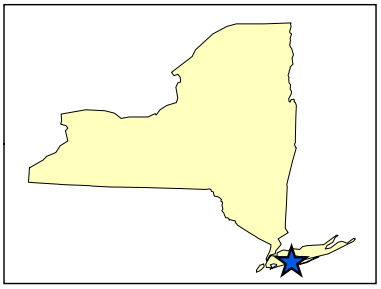

0 100 200
Feet

1 in = 125 ft

N

Legend

OU4 Sampling

- Less than Class C Freshwater SGV
- Greater than Class C Freshwater SGV

Note: Class C Sediment Guidance Values (SGV) as shown in Table 5 and 6 of NYSDEC Screening and Assessment of Contaminated Sediment.. Class C sediments are considered to be highly contaminated and likely pose a risk to aquatic life.

Class C Sediment Guidance Value for Cadmium:
Freshwater = 5 mg/kg

Figure 2-2
Willetts Creek
Sediment Cadmium Exceedances
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 5/13/2018
Projection: NAD83 State Plane New York Long Island

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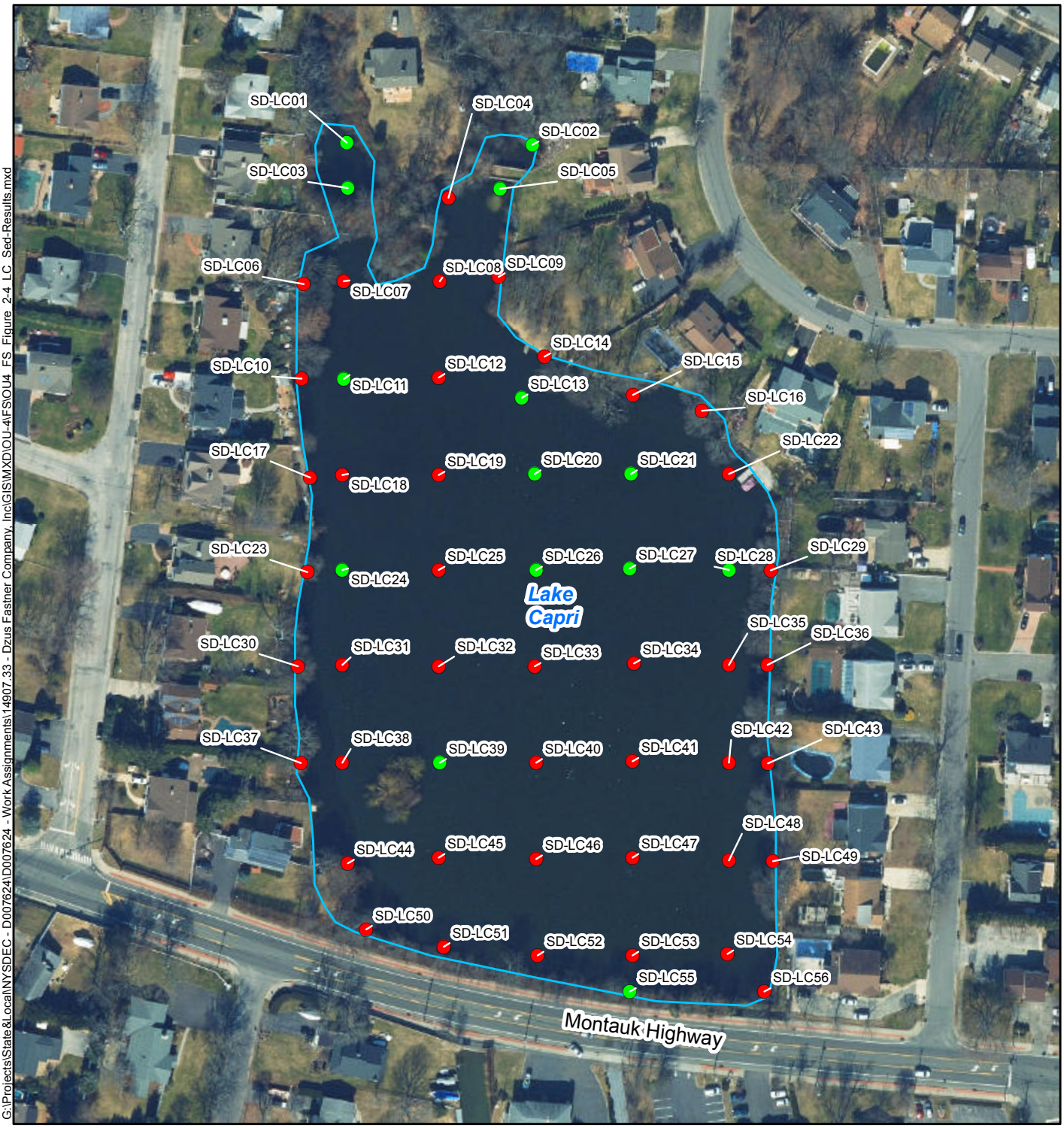

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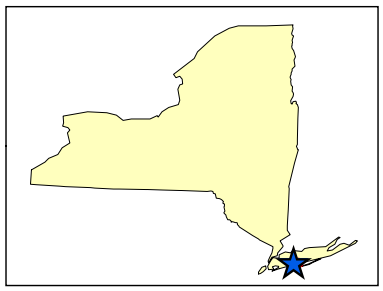

0 100 200
Feet

1 in = 150 ft

N

Legend

OU4 Sampling Results

- Less than Class C Freshwater SGV
- Greater than Class C Freshwater SGV

Note: Class C Sediment Guidance Values (SGV) as shown in Table 5 and 6 of NYSDEC Screening and Assessment of Contaminated Sediment.. Class C sediments are considered to be highly contaminated and likely pose a risk to aquatic life.

Class C Sediment Guidance Value for Cadmium:
Freshwater = 5 mg/kg

Figure 2-3
Lake Capri
Cadmium Exceedances in Sediment

Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/7/2018
Projection: NAD83 State Plane
New York Long Island

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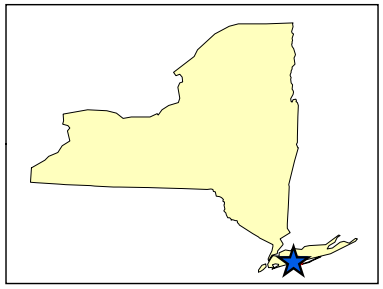

0 125 250
Feet

1 in = 200 ft

N

Legend

- Lake Capri
- Sample Location

Maximum Depth of Exceedance

(inches below bottom surface)

- 0 to 6
- 6 to 12
- 12 to 18
- 18 to 24

Note: Class C Sediment Guidance Value for Cadmium:
Freshwater = 5 mg/kg

Figure 2-4
Maximum Depth of Class C Exceedance Sediment in Lake Capri
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/7/2018
Projection: NAD83 State Plane New York Long Island

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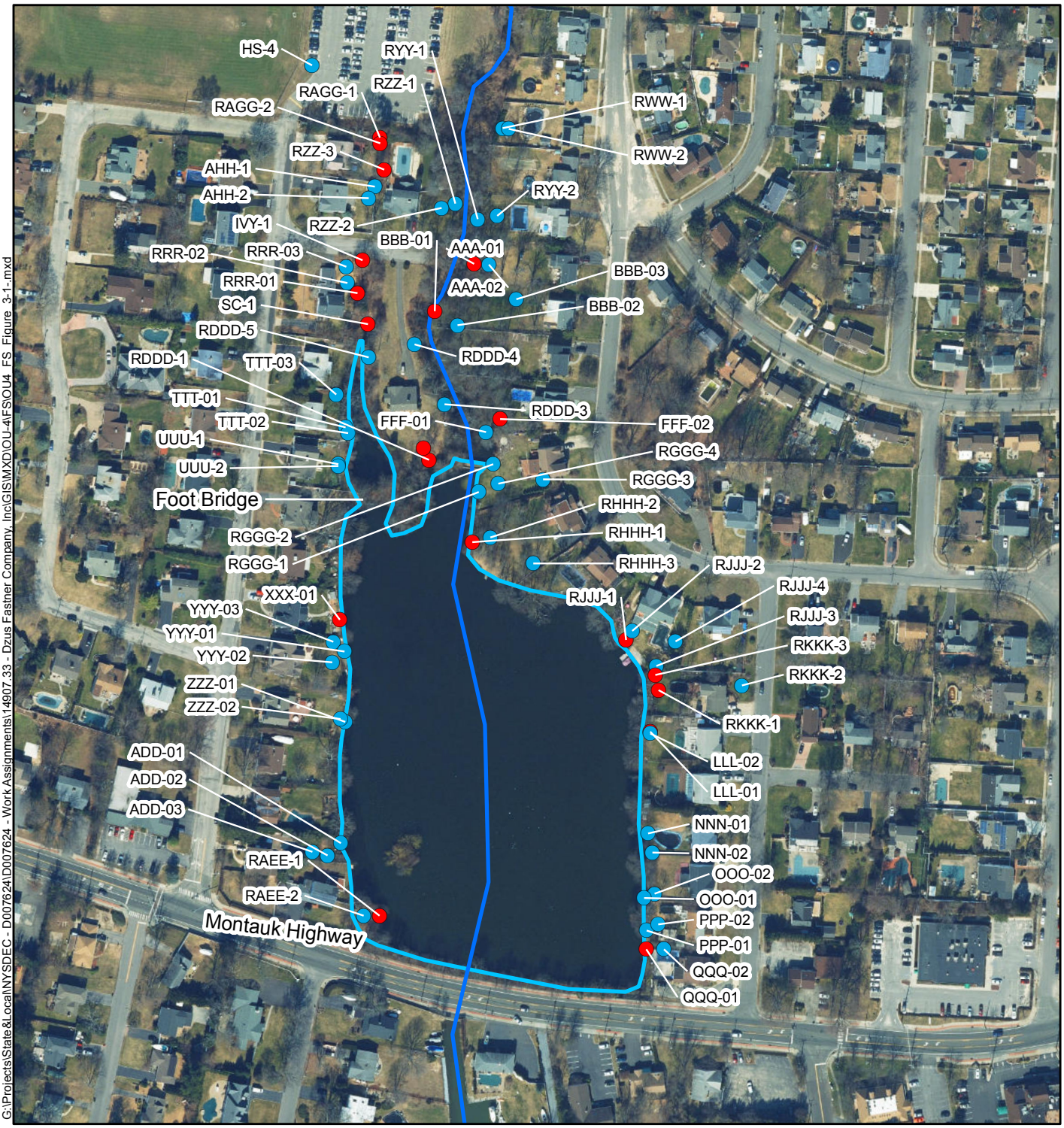

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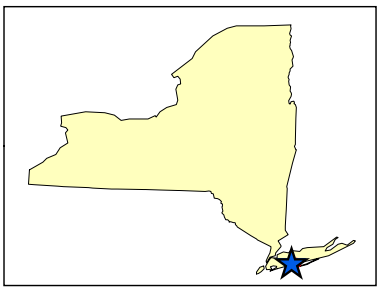

0 100 200
Feet

1 inch = 237 feet

N

Legend

- Willletts Creek
- Lake Capri
- Less than or equal to Unrestricted Use SCO
- Greater than Unrestricted Use SCO

Note: SCO= Soil Cleanup Objective
ppm= parts per million
Unrestricted Use SCO: Cadmium= 2.5 ppm; Chromium= 30 ppm
as determined by NYSDEC 6 NYCRR Table 375-6.8(a)
Date includes Historical data and 2018 Remedial Investigation data

Figure 3-1
Soil Exceeding Soil Cleanup Objective
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 8/8/2018
Projection: NAD83 State Plane New York Long Island

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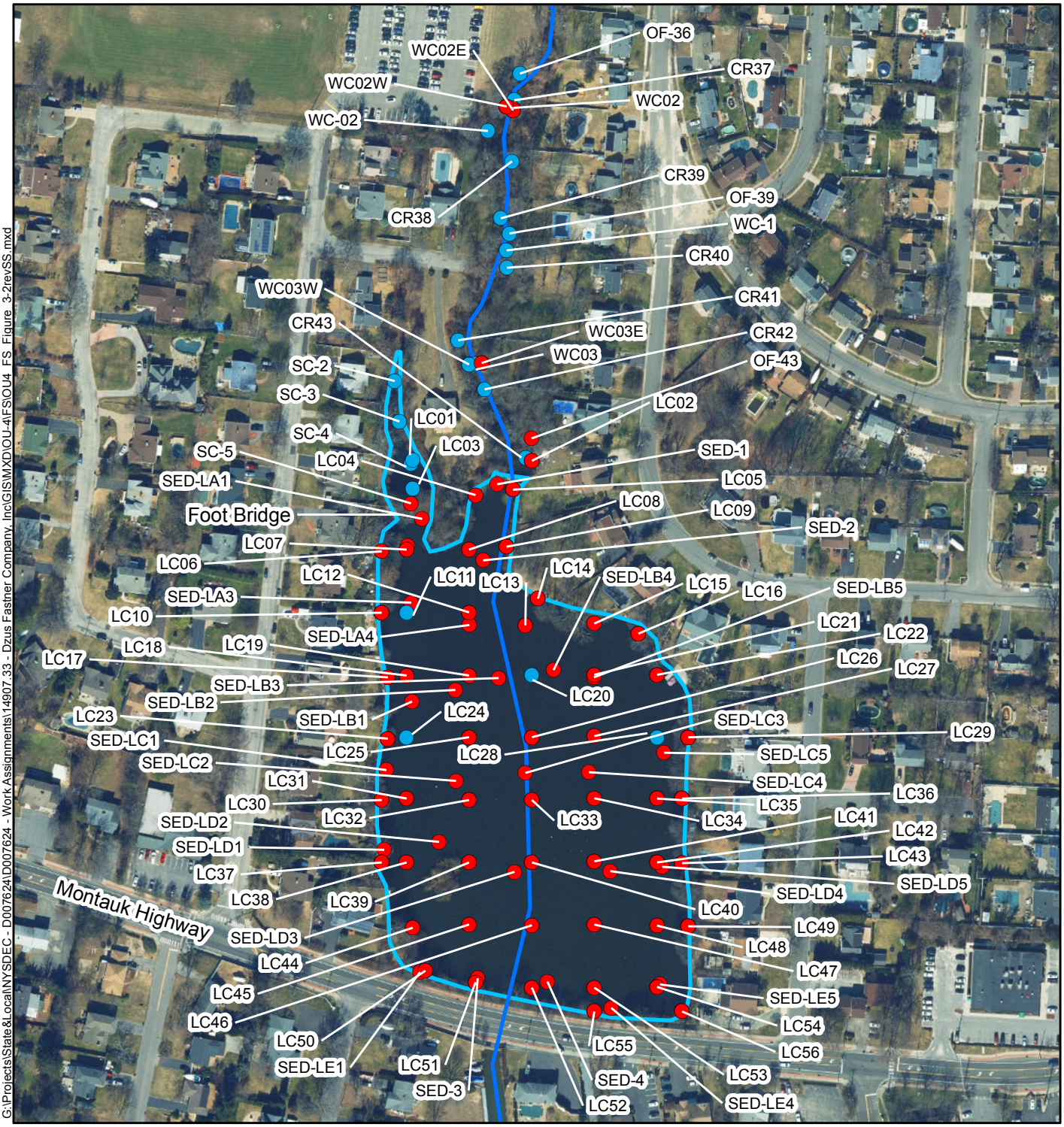

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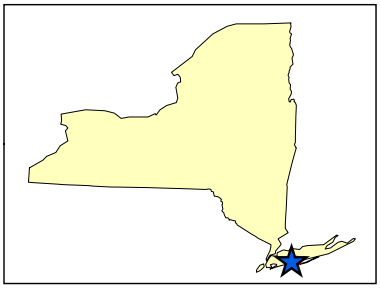

0 100 200
Feet

1 inch = 231 feet

N

Legend

- Willletts Creek
- Lake Capri
- Less than or equal to lower limit of Class B SGV
- Greater than lower limit of Class B SGV

Note: SGV= Sediment Guidance Value
ppm= parts per million

Lower limit of Class B = 1 ppm
Class B SGV (freshwater): Cadmium= 1-5 ppm; Chromium= 43-110 ppm
for low risk to aquatic life dtermined by NYSDEC Technical
Guidance for Screening and Assessment of Contaminated Sediment (June 2014).
Date includes Historical data and 2018 Remedial Investigation data

Figure 3-2
Sediment Exceeding Sediment Guidance Value
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 5/16/2018
Projection: NAD83 State Plane New York Long Island

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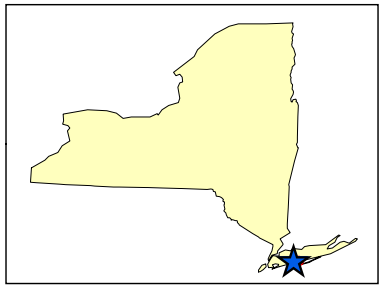

0 75 150
Feet

1 inch = 101 feet

Legend

- Creek Removal- 1.5ft
- Wetland Removal- 1.5ft
- Residential Removal- 1ft avg

Lake Capri Removal (ft)

- 0.5
- 1
- 1.5
- 2
- 2.5

Notes: Soil and sediment removal is in the zone of impact where cadmium and chromium were observed above unrestricted use SCOs for soil and lower limit of Class B SGV for sediment.
SGV=Sediment Guidance Value; SCO= Soil Cleanup Objective
Exc. = Exceedance; avg =average
Unrestricted Use SCOs: Cadmium= 2.5 mg/kg; Chromium= 30 mg/kg as determined by NYSDEC 6 NYCRR Table 375-6.8(a).
Class B SGV: Cadmium= 1-5 mg/kg; Chromium= 43-110 mg/kg for low risk to aquatic life determined by NYSDEC Technical Guidance for Screening and Assessment of Contaminated Sediment (June 2014).

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Figure 6-1A
Alternative 3: Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 9/24/2018
Projection: NAD83 State Plane New York Long Island

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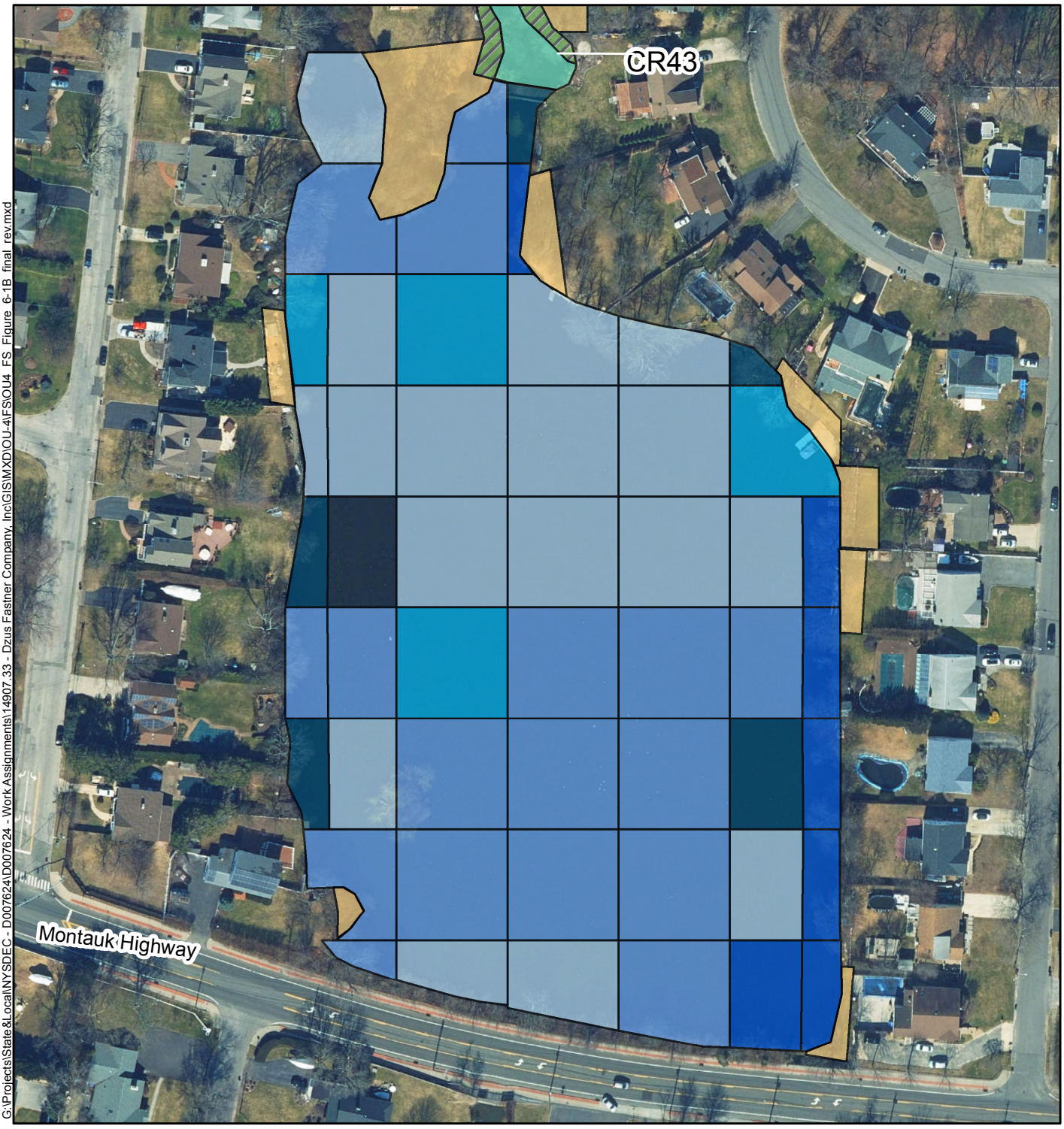

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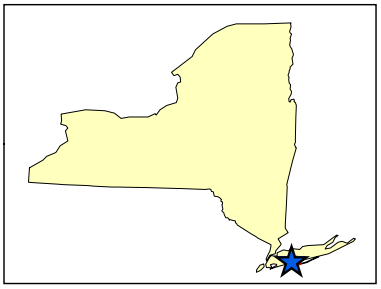

0 75 150
Feet

1 inch = 130 feet

Legend

- Creek Removal- 1.5ft
- Wetland Removal- 1.5ft
- Residential Removal- 1ft avg

Lake Capri Removal (ft)

- 0.5
- 1
- 1.5
- 2
- 2.5

Notes: Soil and sediment removal is in the zone of impact where cadmium and chromium were observed above unrestricted use SCOs for soil and lower limit of Class B SGV for sediment.
SGV=Sediment Guidance Value; SCO= Soil Cleanup Objective
Exc. = Exceedance; avg =average
Unrestricted Use SCOs: Cadmium= 2.5 mg/kg; Chromium= 30 mg/kg as determined by NYSDEC 6 NYCRR Table 375-6.8(a).
Class B SGV: Cadmium= 1-5 mg/kg; Chromium= 43-110 mg/kg for low risk to aquatic life determined by NYSDEC Technical Guidance for Screening and Assessment of Contaminated Sediment (June 2014).

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Figure 6-1B
Alternative 3: Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

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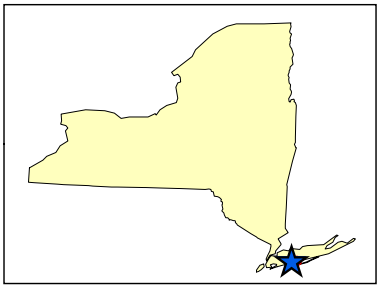

0 75 150
Feet

1 inch = 101 feet

Legend

- Creek Removal- 1.5ft
- Wetlands Removal- 1.5ft
- Residential Removal- 1ft avg

Lake Capri Removal (ft)

0.5 1.5 2.5
1 2 3

Notes: SGV=Sediment Guidance Value; SCO= Soil Cleanup Objective
Exc. = Exceedance; avg =average
Unrestricted Use SCOs: Cadmium= 2.5 mg/kg; Chromium= 30 mg/kg as determined by NYSDEC 6 NYCRR Table 375-6.8(a)
Class A SGV(freshwater): Cadmium <1 mg/kg; Chromium <43 mg/kg for low risk to aquatic life as determined by NYSDEC Technical Guidance for Screening and Assessment of Contaminated Sediment (June 2014).

N

Figure 6-2A
Alternative 4: Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 9/24/2018
Projection: NAD83 State Plane New York Long Island

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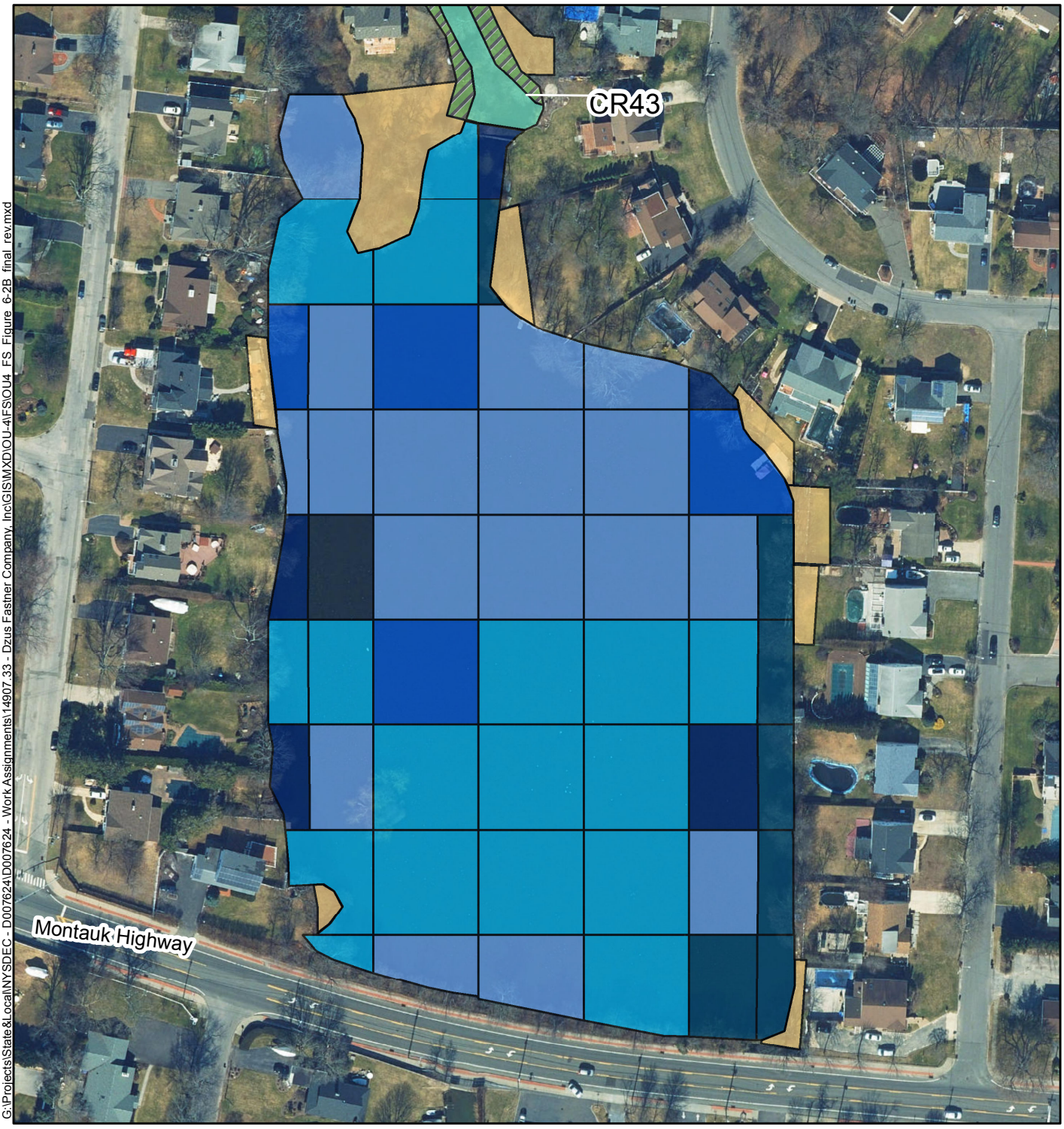

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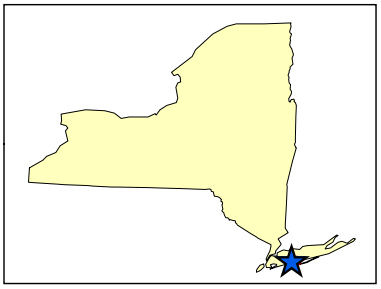

0 75 150
Feet

1 inch = 137 feet

Legend

- Creek Removal- 1.5ft
- Wetland Removal- 1.5ft
- Residential Removal- 1ft avg

Lake Capri Removal (ft)

- 0.5
- 1
- 1.5
- 2
- 2.5
- 3

Notes: SGV=Sediment Guidance Value; SCO= Soil Cleanup Objective
Exc. = Exceedance; avg =average
Unrestricted Use SCOs: Cadmium= 2.5 mg/kg; Chromium= 30 mg/kg
as determined by NYSDEC 6 NYCRR Table 375-6.8(a)
Class A SGV(freshwater): Cadmium <1 mg/kg; Chromium <43 mg/kg
for low risk to aquatic life as determined by NYSDEC Technical
Guidance for Screening and Assessment of Contaminated Sediment (June 2014).

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Figure 6-2B
Alternative 4: Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 9/24/2018
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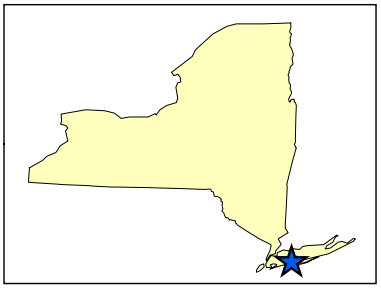

0 75 150
Feet

1 inch = 101 feet

N

Legend

Cap type for exceedances of Residential Use SCO for soil and Lower Limit of Class B SGV for sediment

- Willetts Creek/Wetland (1.5 ft)
- Lake Capri (1 ft)
- Residential (2 ft)

Note:
SGV=Sediment Guidance Value; SCO= Soil Cleanup Objective
ppm= parts per million
Residential Use SCO: Cadmium= 2.5 ppm; Chromium= 36 ppm
as determined by NYSDEC 6 NYCRR Table 375-6.8(b).
Class B SGV (freshwater): Cadmium= 1-5 ppm; Chromium= 43-110 ppm
for low risk to aquatic life dtermined by NYSDEC Technical
Guidance for Screening and Assessment of Contaminated Sediment (June 2014).

Figure 6-3A
Alternative 5: Excavation with Capping of Soil and Sediment
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
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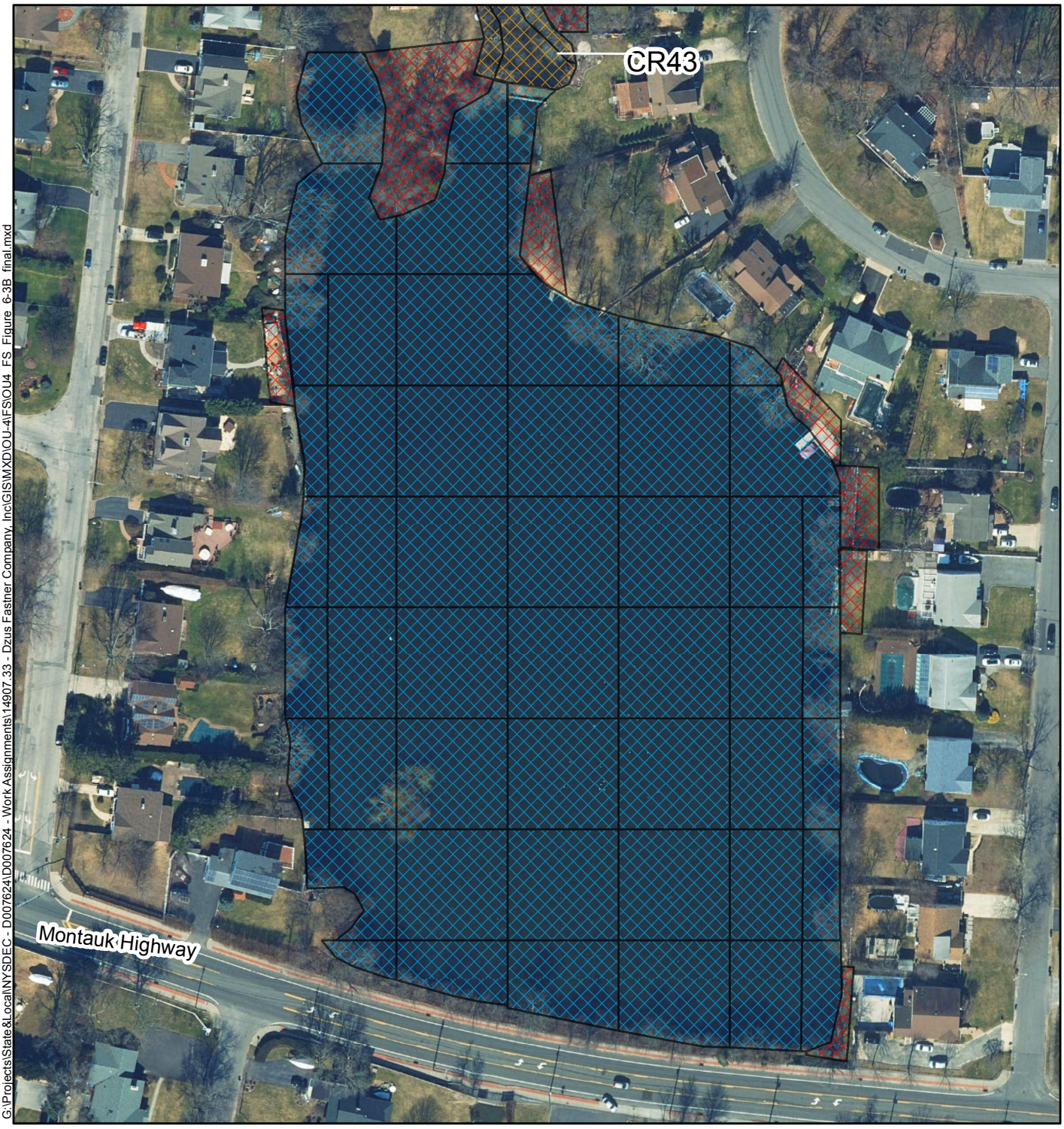

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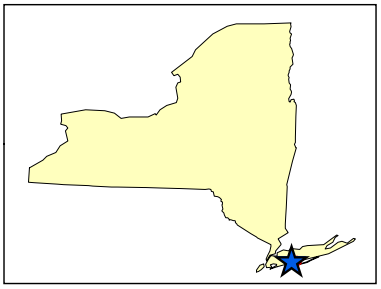

0 75 150
Feet

1 inch = 130 feet

Legend

Cap type for exceedances of Residential Use SCO for soil and Lower Limit of Class B SGV for sediment

- Willetts Creek/Wetland (1.5 ft)
- Lake Capri (1 ft)
- Residential (2 ft)

Figure 6-3B
Alternative 5: Excavation with Capping of Soil and Sediment
Dzus Fastener Company, Inc.
OU4 Feasibility Study Report
West Islip, NY

Map Date: 9/24/2018
Projection: NAD83 State Plane New York Long Island

Note:
SGV=Sediment Guidance Value; SCO= Soil Cleanup Objective
ppm= parts per million
Residential Use SCO: Cadmium= 2.5 ppm; Chromium= 36 ppm
as determined by NYSDEC 6 NYCRR Table 375-6.8(b).
Class B SGV (freshwater): Cadmium= 1-5 ppm; Chromium= 43-110 ppm
for low risk to aquatic life dtermined by NYSDEC Technical
Guidance for Screening and Assessment of Contaminated Sediment (June 2014).

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Tables

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Table 5-1A Technology Screening Matrix (Soil)

FOR SOIL/FILL MATERIAL						
Technology	**Process Options**	**Effectiveness in Addressing RAOs**	**Implementability**	**Key Factors**	**Cost**	**Status**
No Action						
No Action	NA	Ineffective	Easily implemented	NA	None	Retained per NCP
Site Management						
Engineering and Institutional Controls	Land use restrictions in the form of an environmental easement and installation of access.	Effective for human health risk RAOs associated with contact of fill.	Easily implemented	Requires regulatory and public acceptance of restricted/diminished resource use.	Low	Retained for potential combination with other technologies.
In Situ Biological Treatment						
Phytoremediation	Reliance on natural processes and chemical change.	Effective for removal of metals from shallow soils, but less to not effective with deeper impacted soil.	Moderately difficult to implement due to maintenance requirements; requires demonstration of natural processes causing attenuation and subsequent monitoring; limited to growing season.	Treatment period is longer than other technologies, and requires frequent monitoring and maintenance. Requires regulatory and public acceptance of short-term restrictions on resource use.	Low	Not retained
Containment						
Capping	Multimedia cap	Effectively addresses RAOs associated with contact of fill.	Relatively easy to implement; requires monitoring of cap thickness; periodic maintenance and monitoring.	Would require removal of some soil to allow for cap placement due to location of contamination within flood zone; effective in the long term, but would require long-term monitoring.	Moderate	Retained for consideration
	Impermeable Liner (e.g., clay, plastic, etc.).	Effectively addresses RAOs associated with contact of fill.	Relatively easy to implement; requires periodic maintenance and monitoring.	Would require removal of some soil to allow for cap placement due to location of contamination within flood zone; impermeable liner would cause ponding and increase runoff into adjacent stream; effective in the long term, but would require long term monitoring	Moderate	Not retained
In situ Physical/Chemical Treatment						
In situ Stabilization and Solidification	Addition of amendments/reagents to soil/fill to convert contaminants to stable compounds with reduced or eliminated leaching potential; requires in situ mixing.	Effective for risk-based RAOs and partially effective for source control; would require leachability testing to measure the immobility of contaminants; does not reduce volume of contamination on site.	Requires import and availability of suitable materials/reagents (e.g., Portland, gypsum, apatite, etc.); periodic monitoring.	Causes significant disturbance to site that may hinder future use; volume increase with bulk can be significant, and would require some removal due to location of contamination within flood zone; reduced permeability would cause ponding and increase runoff into adjacent stream; effective in the long term but would require long term monitoring.	Moderate	Not retained
Soil Flushing	Extraction of contaminants from soil with water or other suitable aqueous solutions; soil flushing process includes injection or infiltration process of extraction fluid through soil in situ.	Effective for shallow soils.	Considered an emerging technology, has not been widely implemented; addition of environmentally compatible solvents may be used to increase effective solubility of some contaminant of concerns; however, flushing solution may alter the physical/chemical properties of the soil system; technology offers the potential for recovery of metals and can mobilize a wide range of organic and inorganic contaminants from coarse-grained soils.	Capture of groundwater and flushing fluids with desorbed contaminants would need treatment to meet appropriate discharge standards prior to release to local, publicly owned wastewater treatment works or receiving streams; separation of solvents from recovered flushing fluid, for reuse in the process, is a major factor in the cost of soil flushing. Treatment of the recovered fluids results in process sludges and residual solids, such as spent ion exchange resin, which must be appropriately treated before disposal. Residual flushing additives in soil may be a concern.	High	Not retained
Removal						
Excavation	Mechanical excavation used to remove soil/fill material.	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below.	Implementable; moderately difficult to implement; potential for dewatering needs once groundwater is encountered; access/mobility at the creek will be limiting.	Could require establishment of dewatering facilities which could slow process.	High	Retained for consideration
Ex Situ Physical/Chemical Treatment						
Ex situ Chemical Treatment	Acid leaching used to remove inorganics from soil/fill.	Effective at removing inorganics from soil/fill.	Difficult to implement; requires establishment of a designated treatment facility using potentially hazardous chemicals to remove inorganics from fill.	Requires long term use of facilities for soil/fill treatment and disposal or recycling of leached fluids; rate of treatment may limit rate of excavation and disposal; requires use and maintenance of specialized equipment and chemicals.	High	Not retained
	Vitrification used to convert inorganic contaminants to inert forms.	Effective at removing inorganics from soil/fill.	Difficult to implement; requires establishment of a designated treatment facility using high temperature processes to vitrify soil/fill.	Requires long term use of facilities for soil/fill treatment and disposal; rate of treatment may limit rate of excavation and disposal; requires use and maintenance of specialized equipment.	High	Not retained
Disposal						
Offsite Disposal	Offsite commercial landfill.	May be required for excavation options to meet RAOs.	Low degree of difficulty to implement; requires identification of landfills capable of accepting material; landfill capacity and permitting may limit excavation and disposal rates.	Material may require dewatering, stabilization, or treatment to meet criteria for acceptance. Long-range transport may be required dependent on landfill capacity/location; extensive site work and earthwork to accommodate transportation of material.	High	Retained for consideration

NOTES:
RAO = Remedial Action Objective
NA = Not Applicable
NCP = National Contingency Plan

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Table 5-1B Technology Screening Matrix (Sediment)

FOR SEDIMENT						
Technology	**Process Options**	**Effectiveness in Addressing RAOs**	**Implementability**	**Key Factors**	**Cost**	**Status**
No Action						
No Action	NA	Ineffective	Easily implemented	NA	None	Retained per NCP
Site Management						
Engineering and Institutional Controls	Land use restrictions in the form of an environmental easement and installation of access.	Effective for human health risk RAOs associated with contact of fill; ineffective at reducing volume or mobility of contaminant.	Easily implemented	Requires regulatory and public acceptance of restricted/diminished resource use.	Low	Retained for potential combination with other technologies
Containment						
In situ Subaqueous Capping - Physical Barrier	Thin layer capping with armor material (gravel or stone, less than 1 ft thick).	.Moderately effective for risk-based RAOs.	Moderately difficult to implement; requires import of stone; placement in water; monitoring of cap thickness; periodic maintenance & monitoring.	Would require partial removal of sediment in Willetts Creek for cap placement so stream elevation does not change; would require partial sediment removal in some parts of Lake Capri area to maintain the water depth in shoreline areas; effectiveness for source control uncertain; long term source control effective only if contaminant is of limited solubility; potentially useful if used as a cap for residuals post sediment removal.	Moderate	Retained for consideration
	Multi-media cap	Effectively addresses RAOs.	Moderately difficult to implement; requires import of sand, stone, clay placement in water; monitoring of cap thickness; periodic maintenance and monitoring.	Would require partial removal of sediment in Willetts Creek for cap placement so stream elevation does not change; would require partial sediment removal in some parts of Lake Capri area to maintain the shoreline water depths in shoreline areas; effective in long term source control unless inorganics are soluble and upwelling is substantial; would require long-term monitoring.	Moderate	Retained for consideration
	Impermeable Liner (e.g., clay, plastic, etc.).	Effectively addresses RAOs.	Moderately difficult to implement; requires import of liners; placement in water; periodic maintenance and monitoring.	Would require partial removal of sediment so stream elevation does not change as well as to maintain the shoreline water depths in the lake; potential to affect drainage characteristics of creek and alter site hydrology and the storm water retention capacity of Lake Capri; covers over habitat but effectively blocks transport.	Moderate	Not retained
In situ Subaqueous Capping - Reactive Cap	Capping using activated carbon/organo-carbon in a thin layer (less than 3 in.) or mixed with sand.	Effective for risk-based RAOs and partially effective for source control.	Moderately difficult to implement; requires import of special materials (i.e. Sedi-mite, activated carbon, organic carbon, or similar products); placement in water; monitoring of cap thickness; periodic maintenance and monitoring.	Would require partial removal of sediment so stream elevation does not change as well as to maintain shoreline water depths in the lake; may result in change of habitat; effective in long-term source control unless inorganics are soluble.	Moderate	Not retained
	Capping using sequestering amendments (bauxite, barite, limestone), biopolymers (chitosan), or other compounds (zeolite, organoclay, apatite) in a thin layer (less than 3 in.) or mixed with sand.	Effective for risk-based RAOs and partially effective for source control.	Moderately difficult to implement; requires import of special materials (i.e. amendments); placement in water; monitoring of cap thickness; periodic maintenance and monitoring.	Would require partial removal so stream elevation does not change; long-term effectiveness is still subject to evaluation; binding likely to decrease toxicity and dissolved phase mobility but does not inhibit physical transport.	Moderate	Not retained
In situ Biological Treatment						
Phytoremediation	Reliance on natural processes for contaminant removal.	Effective for risk-based RAOs and source control; ineffective if metals are not soluble.	Difficult to implement; limited to areas that will support wetland plant growth; requires planting of appropriate species and subsequent harvest for disposal which may be disruptive to the adjacent residences. May require long time frames, and effectiveness may be limited.	Would require alteration of site wetland habitats; would not provide short-term risk reduction and overall effectiveness may be limited.	Moderate	Not retained
In situ Physical/Chemical Treatment						
In situ Chemical Treatment	Addition of amendments to sediment; may require in situ mixing.	Effective for risk-based RAOs and partially effective for source control.	Difficult to implement; requires import of special materials (e.g., Sedi-Mite, activated carbon, gypsum, apatite, etc.); placement in water; mixing of upper layers of sediment; periodic monitoring.	Causes significant disturbance to habitat; effective long-term source control for dissolved phase, but does not prevent physical transport.	Moderate to high	Not retained
In situ Physical/Chemical Treatment	Solidification/stabilization.	Effective for risk-based RAOs and source control; ineffective if metals are not soluble; ineffective at reducing volume of contamination.	Difficult to implement; requires import of stabilization amendments; placement in water; mixing of upper layers of sediment; periodic monitoring.	Causes significant disturbance to habitat and long-term change in sediment properties; effective long-term source control.	Moderate to high	Not retained
Removal						
Hydraulic Dredging	Hydraulic excavation used to remove sediment.	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below.	Moderately difficult to implement; requires waterway access by hydraulic dredging equipment; requires subsequent dewatering to remove water added by hydraulic conveyance and the addition of material amendments to facilitate handling and disposal.	Requires establishment of dewatering facilities; rate may be limited by capacity of dewatering facility; rate may also be affected by sediment type; dredging typically requires water quality monitoring and resuspension/residuals controls.	High	Retained for consideration
Mechanical Dredging	Mechanical excavation used to remove sediment.	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below.	Moderately difficult to implement; low in contaminant and sediment release control; requires waterway access by dredging equipment; complicated dredge material conveyance issue due to adjacent residential homes; less dewatering required than for hydraulic dredging; may require the addition of material amendments to facilitate handling and disposal; buried debris, rocks, or bedrock may limit dredging implementation.	Requires establishment of dewatering facilities; rate may be affected by complicated dredge material conveyance issue and presence of debris or obstacles to dredging; rate may be limited by dewatering practices; dredging typically requires water quality monitoring and resuspension/residuals controls.	High	Retained for consideration
Excavation	Mechanical excavation used to remove sediment after the water above the sediment has been removed.	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below.	Moderately difficult to implement due to access issue; high groundwater table and conductive aquifer create difficulty in dewatering; potential for additional dewatering or solidification of excavated sediment.	Requires establishment of dewatering facilities; rate may be limited by dewatering practices which could slow process.	High	Retained for consideration
Ex situ Physical/Chemical Treatment						
Solidification or Stabilization	Amendments added to modify physical and chemical properties of material to facilitate handling and disposal.	Effective at immobilizing inorganics within fill.	Relatively easy to implement; can be performed on small batches as material is staged for transport; requires import and addition of amendments; result is decreased water content and toxicity and mobility of contaminants; volume increase.	Requires use of amendments to achieve stabilization.	Moderate	Retained for consideration
Disposal						
Offsite Disposal	Offsite commercial landfill.	Would be required for excavation options to meet RAOs.	Moderately difficult to implement; requires identification of landfills capable of accepting material; landfill capacity may limit excavation and disposal rates.	Material would require dewatering, stabilization, or treatment to meet criteria for acceptance. Long range transport may be required dependent on landfill capacity.	High	Retained for consideration

NOTES:
ft = Feet (foot)
in. = Inch(es)
NA = Not Applicable
NCP = National Contingency Plan
RAO = Remedial Action Objectives

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Table 6-1 Alternatives Screening

Operable Unit 4: Soil/Sediment					
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
	No Action	**Site Management**	**Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV**	**Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV**	**Excavation with Capping of Soil and Sediment**
Size and Configuration of Process Options	NA	An environmental easement would be implemented at the site. Existing institutional controls would be continued to limit the use of the property and groundwater as well as continued monitoring of sediment, surface water, and fish tissue. A fence would be installed and maintained for site security.	Approximately 20,800 cy of contaminated sediment and soil covering 9.5 acres and averaging a depth of 1 ft would be removed from the site by a combination of mechanical excavation and hydraulic dredging. The removed soils and sediment would be dewatered at the onsite temporary solids processing facility and amended for disposal. 1,413 tons of the removed soil and sediment (assumed to be hazardous) would be disposed of at a permitted hazardous waste landfill. Remaining non-hazardous waste (approximately 26,846 tons) would be transported to a general waste landfill. Clean fill would be used to backfill as needed. Water management will be needed to excavate below the water table.	Approximately 23,700 cy of contaminated sediment and soil covering 9.5 acres would be excavated from the site averaging a depth of 1.5 ft would be removed from the site by a combination of mechanical excavation and hydraulic dredging. The removed soils and sediment would be dewatered at the onsite temporary solids processing facility and amended for disposal. 1,610 tons of removed soil and sediment (assumed to be hazardous) would be disposed of at a permitted hazardous waste landfill. Remaining non-hazardous waste (approximately 30,593 tons) would be transported to a general waste landfill. Clean fill would be used to backfill as needed. Water management will be needed to excavate below the water table.	Approximately 9.5 acres would be cleared, partially dredged, and capped with a protective media designed to withstand flood flows when vegetated. Approximately 10,164 cy of contaminated soil and sediment would be excavated or dredged for cap placement. The removed soils and sediment would be dewatered at the onsite temporary solids processing facility and amended for disposal. 392 tons of removed soil and sediment (assumed to be hazardous) would be disposed of at a permitted hazardous waste landfill. Remaining non-hazardous waste (approximately 7,443 tons) would be transported to a general waste landfill. Post-excavation samples will be used to determine if capping is needed. Clean fill would be used to backfill where needed.
Time for Remediation	NA	NA	Approximately 8 months	Approximate 8 months	Approximately 5 months
Spatial Requirements	NA	None	Areas of removal will be inaccessible during remedial activities. Access to the dredging area and temporary facility for solid and water treatment area will be necessary to accommodate dredging activities. Area for equipment storage and loading and unloading for contaminated/clean soil. A minimum of 1 acre would be required.	Areas of removal will be inaccessible during remedial activities. Access to the dredging area and temporary facility for solid and water treatment area will be necessary to accommodate dredging activities. Area for equipment storage and loading and unloading for contaminated/clean soil. A minimum of 1 acre would be required.	Area of excavation will be inaccessible during remedial activities. Access to the excavation area will be necessary to accommodate excavation activities. Area for equipment storage and loading and unloading for contaminated/clean soil . A minimum of 1 acre would be required.
Options for Disposal	NA	NA	Offsite disposal through approved hazardous waste and general waste facilities. Consideration for treatment and reuse of soils would be handled by the facility.	Offsite disposal through approved hazardous waste and general waste facilities. Consideration for treatment and reuse of soils would be handled by the facility.	Offsite disposal through approved hazardous waste and general waste facilities. Consideration for treatment and reuse of soils would be handled by the facility.
Substantive Technical Permit Requirements	None	None	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream, lake, and wetland impacts and if required. Mitigation and annual monitoring required. Any stream diversion/wetland/floodplain related permits. NYSDEC approved creek diversion and contingency plan.	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream, lake, and wetland impacts and if required. Mitigation and annual monitoring required. Any stream diversion/wetland/floodplain related permits. NYSDEC approved creek diversion and contingency plan.	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream, lake, and wetland impacts. Mitigation and annual monitoring required. Any stream diversion/wetland/floodplain related permits. Any stream diversion/wetland/floodplain related permits. NYSDEC approved creek diversion and contingency plan.
Limitations or Other Factors Necessary to Evaluate Alternatives	NA	None	Disposal facilities will require TCLP analysis for waste characterization prior to acceptance.	Disposal facilities will require TCLP analysis for waste characterization prior to acceptance.	Disposal facilities will require TCLP analysis for waste characterization prior to acceptance.
Public Impacts	Will not reduce exposure to contaminants.	Will not physically reduce ecological exposure to contaminants.	Noise, dust, and traffic may disturb local residents and the high school next to the creek and lake area due to limited space and access to perform remediation activity. Existing recreation opportunities in Willetts Creek and Lake Capri area would be temporarily impacted.	Noise, dust, and traffic may disturb local residents and the high school next to the creek and lake area due to limited space and access to perform remediation activity. Existing recreation opportunities in Willetts Creek and Lake Capri area would be temporarily impacted.	Noise, dust, and traffic may disturb local residents. The high school next to the creek and lake area and some residences may be affected due to lack of space and access to perform remediation activity. Existing recreation opportunities in Willetts Creek and Lake Capri area would be temporarily impacted.
Beneficial and/or Adverse Impacts on Fish and Wildlife Resources	Because soil and sediment would be left untreated, it could contribute to further contamination of the creek and lake ecosystem.	Because the soil and sediment would be left untreated, it could contribute to further contamination of the creek and lake ecosystem.	Potential for surface contact would be removed. Complete restoration of the benthic and wetland habitat would be required.	Potential for surface contact would be removed. Complete restoration of the benthic and wetland habitat would be required.	Potential for surface contact would be removed. Complete restoration of the benthic community and wetland would be required. Potential for future exposure due to tree falls and burrowing activity would be present.
Net Present Worth	$0.00	$25,000	$18,184,000	$20,673,000	$7,647,000

NOTES:
cy = Cubic yard
ft = Feet (foot)
NA = Not applicable
NYCRR = New York State Codes, Rules and Regulations
NYSDEC = New York State Department of Environmental Conservation
ppm = Parts per million
SVG = Sediment Guidance Value
SCO = Soil Cleanup Objectives
TCLP = Toxicity Characteristic Leaching Procedure

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Table 7-1 Alternative Cost Summary

Alternative	Description	Capital Cost	Construction Time (months)	Annual Costs Years 1–5/ Years 6–30	Total Cost (Capital + LTM)
1	No Action	$0	0	$0/$0	$0
2	Site Management	$25,000	2	$0/$0	$25,000
3	Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV	$18,130,000	8	$5,000/$3,000	18,184,000
4	Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV	$20,619,000	8	$5,000/$3,000	$20,673,000
5	Excavation with Capping of Soil and Sediment	$7,072,000	5	$5,000/$3,000	$7,647,000

NOTES:
SGV = Sediment Guidance Value
SCO = Soil cleanup objective
LTM = Long-term monitoring

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Table 8-1 Alternative Evaluation Summary

	Operable Unit 4: Soil/Sediment				
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
	No Action	**Site Management**	**Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV**	**Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV**	**Excavation with Capping of Soil and Sediment**
(1) Overall Protection of the Public Health and the Environment					
	There is no reduction of risk with this alternative. The exposure pathways would continue to pose unacceptable risk to all receptors.	There is a slight reduction of risk. Implementation of this alternative would serve to prevent ingestion or direct contact with contaminated sediment.	Reduces potential for human and ecological contact and migration of contaminants through complete removal of soil exceeding Unrestricted Use SCOs and sediment exceeding lower limit of Class B SGV.	Reduces potential for human and ecological contact and migration of contaminants through complete removal of soil exceeding Unrestricted Use SCOs and sediment exceeding Class A SGV.	Capping of impacted area reduces potential for an exposure pathway via surface contact. Continued potential risk of movement of contaminants through sediment bed mobility and surface water if sediment chemistry becomes acidic.
(2) Standards, Criteria and Guidance					
	Does not meet SCG criterion.	Does not meet SCG criterion.	Will meet Unrestricted Use SCOs for soil and lower limit of Class B SGV for sediment.	Will meet Unrestricted Use SCOs for soil and Class A SGV for sediment.	Will meet Residential Use SCOs for soil and lower limit of Class B SGV for sediment.
(3) Long-Term Effectiveness and Permanence					
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls.	As a stand-alone alternative, it is only moderately effective, as contamination will remain in place and physical barriers would prevent human contact or incidental ingestion of sediment/soil.	When designed and implemented properly, effectively eliminates exposure and prevents transport; RAOs are achieved in short time frame.	When designed and implemented properly, effectively reduces exposure and prevents transport; however, long term monitoring of surface water and groundwater would be required.	Cap would need to be maintained against breach through excavation, tree falls, burrowing animals, and increased flows due to storms; long-term monitoring of cap thickness would be required. Site management and perimeter controls are required.
(4) Reduction of Toxicity, Mobility, or Volume of Contamination					
Amount of Hazardous Materials Destroyed, Treated, or	None	None	Will reduce the toxicity, volume and mobility of contamination via soil /sediment removal.	Will reduce the toxicity, volume and mobility of contamination via soil/sediment removal.	Will reduce the toxicity, volume and mobility of contamination via partial soil/sediment removal.
Degree of Expected Reductions in Toxicity, Mobility,	None	None	Contaminated sediment/soil will be disposed of in permitted facilities that use measure to reduce or eliminate the risk of toxic mobility.	Contaminated soil/sediment will be disposed of in permitted facilities that use measures to reduce or eliminate the risk of toxic mobility.	Modest reduction in volume of contaminated soil/sediment and will be disposed of in permitted facilities that use measures to reduce or eliminate the risk of toxic mobility.
Irreversible Treatment?	Not Applicable	Not Applicable	Yes	Yes	Yes
Residuals Remaining After Treatment	Yes	Yes	No soil above unrestricted use SCOs and sediment above lower limit of Class B SGV; contaminated groundwater will remain.	No soil above unrestricted use SCOs and sediment above Class A SGV; contaminated groundwater will remain.	Residual soil/sediment contamination will remain below cap; contaminated groundwater will remain.
(5) Short-Term Impact and Effectiveness					
Community Protection	There is no action; and therefore, no additional risk to the community.	There is no physical action; and therefore, no additional risk to the community.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust/residuals will be produced during mixing activities. These can be mitigated through standard construction practices.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust/residuals will be produced during mixing activities. These can be mitigated through standard construction practices.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust/residuals will be produced during mixing activities. These can be mitigated through standard construction practices.
Worker Protection	There is no action and therefore no workers will be present on site.	There is no physical action; and therefore, no workers will be present at the site	Workers can potentially be exposed to contaminated media during excavation/dredging and mixing activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls and appropriate monitoring.	Workers can potentially be exposed to contaminated media during excavation/dredging and mixing activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls and appropriate monitoring.	Workers can potentially be exposed to contaminated media during excavation/dredging and mixing activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls and appropriate monitoring.
Environmental Impacts	There are no short-term impacts associated with this alternative.	There are no short-term impacts associated with this alternative.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Temporary impacts to lake, creek, wetland and riparian habitats expected.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Temporary impacts to lake, creek, wetland and riparian habitats expected.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Temporary impacts to lake, creek, wetland and riparian habitats expected.
Time Until Action	No action taken	Approximately 2 months for the fence to be installed.	Approximately 8 Months	Approximately 8 Months	Approximately 5 Months
(6) Implementability					
Ability to Construct and Operate	Not Applicable	Institutional and engineering controls can be implemented, and have been used nationally.	Excavation, dredging and disposal alternatives can be implemented, and have been used nationally.	Excavation, dredging and disposal alternatives can be implemented, and have been used nationally.	Capping in riparian/stream, floodplain, or lake areas must be designed to resist transport. Able to be implemented with specialty contractors and appropriate equipment.
Monitoring Requirements	Not Applicable	Not Applicable.	Sediment/soil shall be sampled and analyzed to confirm removal of impacted area.	Sediment/soil shall be sampled and analyzed to confirm removal of impacted area.	Perimeter monitoring and initial characterization recommended. Cap must be monitored for stability.
Availability of Equipment and Specialists	Not Applicable	Specialists are available for the implementation of institutional and engineering controls.	Equipment and specialists are available for the implementation of all of these technologies.		
Ability to Obtain Approvals and Coordinate with	Not Applicable	Ability to obtain approvals and coordinate with other agencies assumed to be possible.	Ability to obtain approvals and coordinate with other agencies assumed to be possible.		
(7) Cost Effectiveness					
Cost	**$0**	**$25,000**	**$18,184,000**	**$20,673,000**	**$7,647,000**
(8) Land Use					
	NA	Restricted	Unrestricted	Unrestricted	Restricted
(9) Community Acceptance					
	TBD	TBD	TBD	TBD	TBD

NOTES:
ARARs = Applicable or Relevant and Appropriate Requirements
PPE = Personal protective equipment
SCO = Soil Cleanup Objectives
SGV = Sediment Guidance Value
SCG = Standards, Criteria and Guidance
TBD = To be determined

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Appendix A

Costs

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TECHNOLOGY	LOCATION	MEDIA	Estimated Cost to Implement	$18,184,000
Alternative 3 **Excavation of Soil to Unrestricted Use SCOs, Removal of Sediment in Willetts Creek to Native Material, and Removal of Sediment in Lake Capri to Lower Limit of Class B SGV**	**Dzus Fastener Site** **West Islip, NY**	**Soil & Sediment**	**Construction Time:**	**8 months**
			Operation Time:	**- months**
			Post Remediation Monitoring	**30 years**

		Quantities		Cost Breakdown (if available)						Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$18,130,000**
Construction Activities		**1**									**$13,959,459**
Pre-Construction											
Permitting	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 60,000	$60,000
Pre Design Investigation	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 150,000	$150,000
Treatability Studies	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$250,000
Site Preparation											
Survey/Boundaries & Markers	*01 71 23.13 1100*	1	day	$ -	$ -	$ 1,288.05	$ 1,288	$ 48	$ 48		$1,336
Clearing & Grubbing, cut & chip light trees, to 6" diameter	*31 11 10.10 0020*	1	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,744	$5,744
Clearing & Grubbing, grub stumps and remove	*31 11 10.10 0150*	1	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,007	$2,007
Topographic and Bathymetric Survey	*Recent quote*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,000	$36,000
Stream Diversion Pipe	*33 41 13 50 1090*	600	lf	$ 24.98	$ 14,988	$ 12.06	$ 7,236	$ 0.87	$ 522		$22,746
Stream Diversion Pipe Inlet Sandbags	*Alternatives Analysis*	160	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 5	$800
Stream Diversion Outlet Rip Rap	*Alternatives Analysis*	173	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 76	$13,113
Stream Diversion Outlet Geotextile Fabric	*Alternatives Analysis*	173	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3	$433
Stream Diversion Outlet Crushed Stone	*Alternatives Analysis*	7.2	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 42	$302
Stream Diversion Pump (excludes pipe installation cost)	*Alternatives Analysis*	1	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 65,125	$65,125
Foot Bridge Removal	*Alternative Analysis*	200	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 20	$3,938
Foot Bridge Replacement	*Alternative Analysis*	200	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 154	$30,800
Utility Locator (based on recent bids)	*recent quote*	1	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,582	$2,582
Erosion and Sediment Control	*Alternative Analysis*	600	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 7	$4,482
Work Plan Preparation (Including QAPP, FAP and HASP)	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$15,000
Fence Demolition	*02 41 13.62 1100*	1,200	lf	$ -	$ -	$ 1.55	$ 1,860	$ 0.51	$ 612		$2,472
Fence Post Removal	*02 4113 62 1000*	120	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 29.24	$3,509
Traffic Control	*Engineer's Estimate*	4	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,000.00	$36,000
Job Trailer (2 trailers)	*Engineer's Estimate*	7	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,000.00	$42,000
Construction Entrance	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,200.00	$18,200
Barge Construction Access	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000.00	$10,000
Stockpile and Staging Area	*recent quote- The Environmental Service Group*	1	pad	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,537	$11,537
Decontamination Pad	*recent quote- The Environmental Service Group*	1	pad	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,800	$6,800
Hydraulic Dredging											
Reefable floating curtain with anchors	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 60,000	$60,000
Hazardous Dredging	*Engineer's Estimate*	825	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 38	$31,354
Non Hazardous Dredging	*Engineer's Estimate*	15,677	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 38	$595,718
GPS Dredge Tracking System	*Engineer's Estimate*	90	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 600	$54,000
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	1	mo	$ -	$ -	$ 3,400.00	$ 3,400	$ 3,420	$ 3,420	$ -	$6,820
Dust Control, Light	*31 23 23.20 2500*	7	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,250	$8,330
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 195 CY/hr	*31 23 16.42 5300*	4,298	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.58	$6,791
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	4,943	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.52	$22,342
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	4,298	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.49	$10,702
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	4,943	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.46	$7,217
Topographic Survey	*Recent quote*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,000	$4,000
Confirmation Sampling											
Grab Samples- 1 per 900 square feet, 1 per 30 lf along side walls plus 20% QA/QC		75	sample	$ -	$ 50	$ 21.00	$ 1,575		$ -	$ -	$1,625
Lab Analyses - TAL Metals	*Hampton-Clarke Veritech*	75	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 72.98	$5,474
Sediment Dewatering											
Pumps and hoses	*Recent quote- EnviroTrac*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,000	$8,000
Frac Tanks- delivery, pickup, spill guard, tank	*Recent quote- Rain for Rent*	4	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,573	$26,292
Carbon	*Engineer's Estimate*	15,000	lb	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.09	$16,391
Booster pump with maintenance	*Engineer's Estimate*	90	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 600.00	$54,000
Piping, 0.5 mile	*Engineer's Estimate*	90	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 800.00	$72,000
Solids Separation System and Filter Press	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500,000.00	$2,500,000
Water Treatment System	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,100,000.00	$2,100,000
Treatment Building	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 222,391	$222,391
Bag filter housing	*Grainger*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 277.50	$833
Bag filters, pack of 20	*Grainger*	8	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 158.25	$1,266
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	4,943	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.49	$12,308
Sediment Stabilization and Loadout						$ -					
Portland cement for stabilization	*03 05 13.30 0300*	17,209	cwt	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.75	$150,581
Mixing material including added 5% by vol for Portland cement	*32 01 16.71 5400*	17,625	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.42	$25,028
FEL, wheel mount, 2 1/4 CY cap. Loadout into dumps from stockpiles	*31 23 16.42 1600*	22,568	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.09	$47,167
Spotter at loadout	*31 23 23.20 2310*	685	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 71.34	$48,873
Non-Hazardous Disposal						$ -					
Soil transportation and disposal	*Bid Average for Dzus IRM*	26,846	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 210.00	$5,637,660
Waste Characterization	*Recent Quote*	34	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 477.00	$15,980
Hazardous Disposal											
Soil transportation and disposal	*Bid average for Dzus IRM*	1,413	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 390.00	$551,049
Site Restoration											
Wetland Restoration	*Alternatives Analysis*	0.38	acre	$ -	$ -	$ -	$ -	$ -	$ -	$106,200	$40,680
Tree Restoration	*Alternatives Analysis*	300	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 737	$220,995
School property restoration (asphalt)	*Engineer's Estimate*	4,840	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 14	$67,760
School property pre and post remediation sampling	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$10,000
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- EnviroTrac*	4,083	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.00	$163,319
Backfill 300HP Dozer, 150' haul	*31 23 23.14 5220*	4,083	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.72	$7,023
Grading by dozer	*31 23 23.20 2300*	4,083	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.76	$11,269
Compacting backfill, 12" lift, 2 passes w/ drum roller	*31 23 23.23 5060*	4,083	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.33	$1,347
Residual Cover	*Engineer's Estimate*	39,954	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 7.00	$279,676
Walk behind Plate Compactor	*01 54 33.20 1300*	1	month	$ -	$ -	$ 2,073.92	$ 2,074	$ 259	$ 259	$ -	$2,333
Topsoil	*Recent quote- EnviroTrac*	860	lcy	$ 44.50	$ 38,263	$ -	$ -	$ -	$ -	$ -	$38,263
Finishing grading slopes, gentle	*31 22 16.10 3300*	8,769	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.25	$2,192
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	79	msf	$ -	$ -	$ -	$ -	$ -	$ -	$ 73.96	$5,837
Topographic Survey	*02 21 13 09 0020*	1.0	acre	$ 20.06	$ 20	$ 587.90	$ 588	$ 15	$ 15	$ -	$623
Fencing Installation (assume 90% re-used/installed)	*32 31 13.20 0800*	1,200	lf	$ 19.23	$ 2,308	$ 4.46	$ 5,352	$ 1	$ 1,368	$ -	$9,028
Mobilization and Demobilization											**$109,203**
7% of Total Costs of Site Work, Treatment										$1,560,043	$109,203
Contingency											**$1,688,239**
12% of Total Construction Activities										$14,068,662	$1,688,239
Professional/Technical Services											**$2,373,108**
5% Project Management										$13,959,459	$697,972.96
6% Remedial Design											$837,567.55
6% Construction Management											$837,568
LONG TERM MONITORING									**ANNUAL LTM COST (YRS 1-5)**		**$5,000**
									ANNUAL LTM COST (YRS 6-30)		**$3,000**
									LIFETIME LTM (NPV)		**$54,268**
Fill thickness monitoring											$2,376
Inspection of soil cover		4	hr	$ -	$ -	$ 85.00	$ 340	$ -	$ -	$ -	$340
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ 850.00	$ 850	$ 336	$ 336	$ -	$1,186
Reporting		10	hr	$ 85.00	$ 850	$ -	$ -	$ -	$ -	$ -	$850
Cap Repairs											$724
Mobilization/Demobilization		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$500
Supply and Transportation of NYS Certified Clean Back Fill Material, assume 20 x 20 area to be replaced every 5 years, annual cost	*Recent quote- EnviroTrac*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.00	$204
Backfill FEL, minimal haul	*31 23 16.13 3020*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.53	$18
Compacting backfill, 12" lift, 2 passes w/ drum roller	*31 23 23.23 5060*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.33	$2
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + LTM + Maintenance) **$18,184,000**

Assumptions:

Working condition is Safety Level:		D	(Labor productivity:	100%	; Equipment productivity:	100%	)		
Weighted Average of city cost index (Long Island City, NY)		133.5%	(not applicable for costs der	$1					
Costs are loaded with a profit factor		10%							
Inflation		3%	per year						
Estimated number of soil samples		36	samples	1	times sampled	0.25	hrs/sample	$85	Labor Cost per hr
				20%	added for QA/QC samples	1	worker sampling		
Characterization Cost	Table A (per CWM)	$477	per sample						
Analytical cost	TAL Metals	$75	per sample						
For each sampling event, assumed:		$50	for materials (gloves, notebooks, etc.)						

Disposal

Cadmium contaminated soil as haz	$390	per ton	1,413	tons soil/sediment hazardous			
			22	tons per load	64	loads for haz disposal	
Cadmium contaminated soil as non-haz	$210	per ton	26,846	tons soil/sediment for non-haz disposal	1,220	loads for non-haz disposal	
					15	loads per day	
					20	working days per month	

Typical Rental Rates - Includes G&A and 10% Profit

Mini-Rae Survey Mode PID	$96.08	per day	**Hydraulic Dredging**			
Truck/SUV (1/2 ton or smaller)	$70.74	per day	**990**	tons haz sediment, unamended		
Horiba U-10 Water Quality Meter	$73.77	per day	5%	percent haz	**Excavation**	
Submersible Pump	$42.16	per day	**18,812**	tons non-haz sediment, unamended	328	tons soil hazardous, unamended
2 in Pump Control Box	$72.27	per day	95%	percent non-haz	5%	percent-haz
Generator: 110 V	$57.24	per day	**19,802**	tons of sediment unamended, pre-dewatering	6,231	tons soil non-hazardous, unamended
Level D PPE	$11.91	per day	**20,840**	tons of sediment unamended, post-dewatering	95%	percent non-haz
			1,042	tons haz sediment, post-dewatering		
			19,798	tons non-haz sediment, post-dewatering	8	hours per working day
Work day consists of:	8	hrs			3	months for site prep/restoration
			860	tons cement for amendment	5	months loading
			43	tons cement for haz	3	month sediment dewatering/amendment
			817	tons cement for non-haz	8	Total site work

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet	Alternatives Analysis	Alternatives Analysis Report, Dzus Fasteners Site, AECOM, March 2016
sf	square feet		
msf	1,000 square feet		

TECHNOLOGY	LOCATION	MEDIA	Estimated Cost to Implement	$20,673,000	
Alternative 4 Excavation of Soil to Unrestricted Use SCOs and Removal of Sediment to Class A SGV	Dzus Fastener Site West Islip, NY	Soil & Sediment	Construction Time:	8	months
			Operation Time:	-	months
			Post Remediation Monitoring	30	years

		Quantities		Cost Breakdown (if available)						Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$20,619,000**
Construction Activities		**1**			**$15,038**		**$22,706**		**$4,602**	**$5,211,297**	**$14,932,223**
Pre-Construction											
Permitting	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 60,000	$60,000
Pre Design Investigation	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 150,000	$150,000
Treatability Studies	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$250,000
Site Preparation											
Survey/Boundaries & Markers	*01 71 23.13 1100*	1	day	$ -	$ -	$ 1,288.05	$ 1,288	$ 48	$ 48		$1,336
Clearing & Grubbing, cut & chip light trees, to 6" diameter	*31 11 10.10 0020*	1	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,744	$5,744
Clearing & Grubbing, grub stumps and remove	*31 11 10.10 0150*	1	acre		$ -		$ -		$ -	$ 2,007	$2,007
Topographic and Bathymetric Survey	*Recent quote*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,000	$36,000
Stream Diversion Pipe	*33 41 13 50 1090*	600	lf	$ 24.98	$ 14,988	$ 12.06	$ 7,236	$ 0.87	$ 522		$22,746
Stream Diversion Pipe Inlet Sandbags	*Alternatives Analysis*	160	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 5	$800
Stream Diversion Outlet Rip Rap	*Alternatives Analysis*	173	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 76	$13,113
Stream Diversion Outlet Geotextile Fabric	*Alternatives Analysis*	173	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3	$433
Stream Diversion Outlet Crushed Stone	*Alternatives Analysis*	7.2	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 42	$302
Stream Diversion Pump (excludes pipe installation cost)	*Alternatives Analysis*	1	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 65,125	$65,125
Foot Bridge Removal	*Alternative Analysis*	200	sf							$ 20	$3,938
Foot Bridge Replacement	*Alternative Analysis*	200	sf							$ 154	$30,800
Utility Locator (based on recent bids)	*recent quote*	1	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,582	$2,582
Erosion and Sediment Control	*Alternative Analysis*	600	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 7	$4,482
Work Plan Preparation (Including QAPP, FAP and HASP)	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$15,000
Fence Demolition	*02 41 13.62 1100*	1,200	lf	$ -	$ -	$ 1.55	$ 1,860	$ 0.51	$ 612		$2,472
Fence Post Removal	*02 4113621000*	120	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 29	$3,509
Traffic Control	*Engineer's Estimate*	5	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,000	$45,000
Job Trailer (2 trailers)	*Engineer's Estimate*	8	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,000	$48,000
Construction Entrance	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,200	$18,200
Barge Construction Access	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$10,000
Stockpile and Staging Area	*recent quote- The Environmental Service Group*	1	pad	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,537	$11,537
Decontamination Pad	*recent quote- The Environmental Service Group*	1	pad	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,800	$6,800
Hydraulic Dredging											
Reefable floating curtain with anchors	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 60,000	$60,000
Hazardous Dredging	*Engineer's Estimate*	929	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 38	$35,296
Non Hazardous Dredging	*Engineer's Estimate*	17,648	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 38	$670,626
GPS Dredge Tracking System	*Engineer's Estimate*	100	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 600	$60,000
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	1	mo	$ -	$ -	$ 3,400.00	$ 3,400	$ 3,420	$ 3,420	$ -	$6,820
Dust Control, Light	*31 23 23.20 2500*	7	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,250	$8,330
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 195 CY/hr	*31 23 16.42 5300*	5,191	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.58	$8,202
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	5,970	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.52	$26,984
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	5,191	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.49	$12,926
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	5,970	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.46	$8,716
Topographic Survey	*Recent quote*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,000	$4,000
Confirmation Sampling											
Grab Samples- 1 per 900 square feet, 1 per 30 lf along side walls plus 20% QA/QC		425	sample	$ -	$ 50	$ 21.00	$ 8,922		$ -	$ -	$8,972
Lab Analyses - TAL Metals	*Hampton-Clarke Veritech*	425	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 73	$31,005
Sediment Dewatering											
Pumps and hoses	*Recent quote- EnviroTrac*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,000	$8,000
Frac Tanks- delivery, pickup, spill guard, tank	*Recent quote- Rain for Rent*	4	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,573	$26,292
Carbon	*Engineer's Estimate*	15,000	lbs	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.09	$16,391
Booster pump with maintenance	*Engineer's Estimate*	100	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 600	$60,000
Piping, 0.5 mile	*Engineer's Estimate*	100	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 800	80000
Solids Separation System and Filter Press	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500,000	$2,500,000
Water Treatment System	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,100,000	$2,100,000
Treatment Building	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 222,391	$222,391
Bag filter housing	*Grainger*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	278	$833
Bag filters, pack of 20	*Grainger*	8	ea	$ -	$ -	$ -	$ -	$ -	$ -	158	$1,266
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	5,970	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.49	$14,865
Sediment Stabilization and Loadout						$ -					
Portland cement for stabilization	*03 05 13.30 0300*	19,386	cwt	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.75	$169,623
Mixing material in windrow, 180 H.P. grader, including added 5% by vol for portla	*32 01 16.71 5400*	22,304	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.42	$31,672
FEL, wheel mount, 2 1/4 CY cap. Loadout into dumps from stockpiles	*31 23 16.42 1600*	28,274	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.09	$59,093
Spotter at loadout	*31 23 23.20 2310*	781	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 71.34	$55,693
Non-Hazardous Disposal						$ -					
Soil transportation and disposal	*Bid Average for Dzus IRM*	30,593	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 210.00	$6,424,471
Waste Characterization	*Recent Quote*	37	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 477.00	$17,755
Hazardous Disposal											
Soil transportation and disposal	*Bid average for Dzus IRM*	1,610	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 390.00	$627,956
Site Restoration											
Wetland Restoration	*Alternatives Analysis*	0.38	acre	$ -	$ -	$ -	$ -	$ -	$ -	$106,200	$40,680
Tree Restoration	*Alternatives Analysis*	300	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 737	$220,995
School property restoration (asphalt)	*Engineer's Estimate*	4,840	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 14	$67,760
School property pre and post remediation sampling	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$10,000
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- EnviroTrac*	5,110	lcy	$ -	$ -	$ -	$ -	$ -	$ -	40	$204,399
Backfill 300HP Dozer, 150' haul	*31 23 23.14 5220*	5,110	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.72	$8,789
Grading by dozer	*31 23 23.20 2300*	5,110	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.76	$14,104
Compacting backfill, 12" lift, 2 passes w/ drum roller	*31 23 23.23 5060*	5,110	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.33	$1,686
Residual Cover	*Engineer's Estimate*	19,633	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 7.00	$137,432
Walk behind Plate Compactor	*01 54 33.20 1300*	1	month	$ -	$ -	$ 2,073.92	$ 2,074	$ 259	$ 259		$2,333
Topsoil	*Recent quote- EnviroTrac*	860	lcy	$ 44.50	$ 38,263	$ -	$ -	$ -	$ -		$38,263
Finishing grading slopes, gentle	*31 22 16.10 3300*	8,769	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.25	$2,192
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	79	msf	$ -	$ -	$ -	$ -	$ -	$ -	$ 73.96	$5,837
Topographic Survey	*02 21 13 09 0020*	1.0	acre	$ 20.06	$ 20	$ 587.90	$ 588	$ 15	$ 15		$623
Fencing Installation (assume 90% re-used/installed)	*32 31 13.20 0800*	1,200	lf	$ 19.23	$ 2,308	$ 4.46	$ 5,352	$ 1	$ 1,368		$9,028
Mobilization and Demobilization											**$135,145**
7% of Total Costs of Site Work, Treatment										$1,930,642	$135,145
Contingency											**$3,013,474**
20% of Total Construction Activities										$15,067,368	$3,013,474
Professional/Technical Services											**$2,538,478**
5% Project Management										$14,932,223	$746,611
6% Remedial Design											$895,933
6% Construction Management											$895,933
LONG TERM MONITORING										**ANNUAL LTM COST (YRS 1-5)**	**$5,000**
										ANNUAL LTM COST (YRS 6-30)	**$3,000**
										LIFETIME LTM (NPV)	**$54,268**
Fill thickness monitoring											
											$2,376
Inspection of soil cover		4	hr			$ 85.00	$ 340				$340
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ 850.00	$ 850	$ 336	$ 336	$ -	$1,186
Reporting		10	hr	$ 85.00	$ 850	$ -	$ -	$ -	$ -	$ -	$850
Cap Repairs											$724
Mobilization/Demobilization		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$500
Supply and Transportation of NYS Certified Clean Back Fill Material, assume 20 x 20 area to be replaced every 5 years, annual cost	*Recent quote- EnviroTrac*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.00	$204
Backfill FEL, minimal haul	*31 23 16.13 3020*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.53	$18
Compacting backfill, 12" lift, 2 passes w/ drum roller	*31 23 23.23 5060*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.33	$2
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + LTM + Maintenance)											**$20,673,000**

Assumptions:

Working condition is Safety Level: **D** (**Labor productivity:** **100%**; **Equipment productivity:** **100%**)
Weighted Average of city cost index (Long Island City, NY): **133.5%** (**not applicable for costs der** $1
Costs are loaded with a profit factor: **10%**
Inflation: **3%** per year

Estimated number of soil and sediment samples

37 samples; **1** times sampled; **0.25** hrs/sample; **$85** Cost per hr Labor
20% added for QA/QC samples; **1** worker sampling

Characterization Cost (Table A (per CWM)): **$477** per sample
Analytical cost (TAL Metals): **$75** per sample
For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

Disposal

Cadmium contaminated soil as a "listed" waste- incineration: **$390** per ton; **1,610** tons soil/sediment hazardous; **22** tons per load; **73** loads for haz disposal
Cadmium contaminated soil as non-haz: **$210** per ton; **30,593** tons soil/sediment for non-haz disposal; **1,391** loads for non-haz disposal
15 loads per day
20 working days per month

Typical Rental Rates - Includes G&A and 10% Profit

Mini-Rae Survey Mode PID: **$96.08** per day
Truck/SUV (1/2 ton or smaller): **$70.74** per day
Horiba U-10 Water Quality Meter: **$73.77** per day
Submersible Pump: **$42.16** per day
2 in Pump Control Box: **$72.27** per day
Generator: 110 V: **$57.24** per day
Level D PPE: **$11.91** per day

Work day consists of: **8** hrs

Hydraulic Dredging

1,115 tons haz sediment, unamended
5% percent haz
21,178 tons non-haz sediment, unamended
95% percent non-haz
22,292 tons of sediment unamended, pre-dewatering
23,447 tons of sediment unamended, post-dewatering
1,172 tons haz sediment, post-dewatering
22,275 tons non-haz sediment, post-dewatering
969 tons cement for amendment
48 tons cement for haz
921 tons cement for non-haz

Excavation

389 tons soil hazardous, unamended
5% percent-haz
7,397 tons soil non-hazardous, unamended
95% percent non-haz
8 hours per working day
3 months for site prep/restoration
5 months loading
4 month sediment dewatering/amendment
8 Total site work

Notes

sy square yard
cy cubic yard
lcy loose cubic yard
bcy bank cubic yard
lf linear feet
sf square feet
msf 1,000 square feet
mo month
ls lump sum
O&M Operation and maintenance
H&S Health and Safety
Alternatives Analysis Alternatives Analysis Report, Dzus Fasteners Site, AECOM, March 2016

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TECHNOLOGY	LOCATION	MEDIA	Estimated Cost to Implement	$7,647,000
Alternative 5 Excavation with Capping of Soil and Sediment	Dzus Fastener Site West Islip, NY	Soil & Sediment	Construction Time:	5 months
			Operation Time:	- months
			Post Remediation Monitoring	30 years

		Quantities		Cost Breakdown (if available)						Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$7,072,000**
Construction Activities		**1**			**$15,038**		**$14,834**		**$4,602**	**$467,312**	**$5,043,967**
Pre-Construction											
Permitting	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 60,000	$60,000
Pre Design Investigation	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 150,000	$150,000
Treatability Studies	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$250,000
Site Preparation											
Survey/Boundaries & Markers	*01 71 23.13 1100*	1	day	$ -	$ -	$ 1,288.05	$ 1,288	$ 48	$ 48		$1,336
Clearing & Grubbing, cut & chip light trees, to 6" diameter	*31 11 10.10 0020*	1	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,744	$5,744
Clearing & Grubbing, grub stumps and remove	*31 11 10.10 0150*	1.0	acre		$ -		$ -		$ -	$ 2,007	$2,007
Topographic and Bathymetric Survey	*Recent quote*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,000	$36,000
Stream Diversion Pipe	*33 41 13 50 1090*	600	lf	$ 24.98	$ 14,988	$ 12.06	$ 7,236	$ 0.87	$ 522		$22,746
Stream Diversion Pipe Inlet Sandbags	*Alternatives Analysis*	160	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 5	$800
Stream Diversion Outlet Rip Rap	*Alternatives Analysis*	173	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 76	$13,113
Stream Diversion Outlet Geotextile Fabric	*Alternatives Analysis*	173	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3	$433
Stream Diversion Outlet Crushed Stone	*Alternatives Analysis*	7.2	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 42	$302
Stream Diversion Pump (excludes pipe installation cost)	*Alternatives Analysis*	1	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 65,125	$65,125
Foot Bridge Removal	*Alternative Analysis*	200	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 20	$3,938
Foot Bridge Replacement	*Alternative Analysis*	200	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 154	$30,800
Utility Locator (based on recent bids)	*recent quote*	1	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,582	$2,582
Erosion and Sediment Control	*Alternative Analysis*	600	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 7	$4,482
Turbidity Curtain	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$5,000
Work Plan Preparation (Including QAPP, FAP and HASP)	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$15,000
Fence Demolition	*02 41 13.62 1100*	1,200	lf	$ -	$ -	$ 1.55	$ 1,860	$ 0.51	$ 612		$2,472
Fence Post Removal	*02 4113621000*	120	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 29.24	$3,509
Traffic Control	*Engineer's Estimate*	2	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,000	$18,000
Job Trailer (2 trailers)	*Engineer's Estimate*	5	mo	$ -	$ -	$ -	$ -	$ -	$ -	6,000	$30,000
Construction Entrance	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	18,200	$18,200
Barge Construction Access	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$10,000
Stockpile and Staging Area	*recent quote- The Environmental Service Group*	1	pad	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,537	$11,537
Decontamination Pad	*recent quote- The Environmental Service Group*	1	pad	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,800	$6,800
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	1	mo	$ -	$ -	$ 3,400.00	$ 3,400	$ 3,420	$ 3,420	$ -	$6,820
Dust Control, Light	*31 23 23.20 2500*	7	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,250	$8,330
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 195 CY/hr	*31 23 16.42 5300*	10,164	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.58	$16,059
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	11,689	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.52	$52,833
Haul Road Maintenance	*31 23 23.20 2600*	7	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,633	$10,888
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	5,223	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.49	$13,005
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	6,006	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.46	$8,769
Topographic Survey	*Recent quote*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,000	$4,000
Confirmation Sampling											
Grab Samples- 1 per 900 square feet, 1 per 30 lf along side walls plus 20% QA/QC		50	sample	$ -	$ 50	$ 21.00	$ 1,050		$ -	$ -	$1,100
Lab Analyses - TAL Metals	*Hampton-Clarke Veritech*	50	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 72.98	$3,649
Sediment Dewatering											
Stockpile pad											
Geomembrane	*Recent quote-Antana*	65,340	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.67	$109,118
Sand-6 in above, 6 in below geomembrane for protection	*Recent quote- Enviro Trac*	3,104	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.76	$123,401
Stone- 1ft drainage layer	*32 11 23.23 0300*	7,260	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.69	$99,389
Pumps and hoses	*Recent quote- EnviroTrac*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,000	$8,000
Frac Tanks- delivery, pickup, spill guard, tank	*Recent quote- Rain for Rent*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,573	$19,719
Carbon	*Engineer's Estimate*	15,000	lb	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.09	$16,391
Bag filter housing	*Grainger*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 277.50	$833
Bag filters, pack of 20	*Grainger*	8	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 158.25	$1,266
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	6,006	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.49	$14,956
Sediment Stabilization and Loadout						$ -					
Mixing material in windrow, 180 H.P. grader, including added 5% by vol for Portland cement	*32 01 16.71 5400*	6,307	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.42	$8,956
FEL, wheel mount, 2 1/4 CY cap. Loadout into dumps from stockpiles	*31 23 16.42 1600*	6,307	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.09	$13,181
Spotter at loadout	*31 23 23.20 2310*	190	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 71.34	$13,549
Non-Hazardous Disposal						$ -					
Soil transportation and disposal	*Bid average for Dzus IRM*	7,443	ton	$ -	$ -	$ -	$ -	$ -	$ -	210	$1,562,976
Waste Characterization	*Recent quote*	6	ea	$ -	$ -	$ -	$ -	$ -	$ -	477	$2,990
Liquid waste disposal	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	250,000	$250,000
Hazardous Disposal						$ -					
Soil transportation and disposal	*Bid average for Dzus IRM*	392	ton	$ -	$ -	$ -	$ -	$ -	$ -	390	$152,772
Capping											
Deploy 10oz/sy mil Nonwoven Geotextile (Level C)	*ECHOS 2006 33 08 0533*	41,120	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.57	$105,679
Supply and Transportation of Clean Sand to Site	*Recent bids*	7,064	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 25.40	$179,418
Supply and transportation of Clean Graded Armor Stone	*Recent bids*	6,659	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 48.37	$322,093
Placement of Sand 6"-12" thick	*Recent bids*	7,064	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 38.00	$268,420
Placement of Clean Graded Armor Stone 6" thick	*Recent bids*	6,659	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 38.00	$253,040
GPS Dredge Tracking System	*Engineer's Estimate*	45	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 600.00	$27,000
Supply and Transportation of NYS Certified Clean Back Fill Material (Outside water body)	*Recent quote- EnviroTrac*	3,298	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.00	$131,901
Backfill 300HP Dozer, 150' haul (Outside water body)	*31 23 23.14 5220*	3,298	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.72	$5,672
Grading by dozer (Outside water body)	*31 23 23.20 2300*	3,298	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.76	$9,101
Compacting backfill, 12" lift, 2 passes w/ drum roller (Outside water body)	*31 23 23.23 5060*	3,298	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.35	$1,154
Post capping verification											
Verification sampling	*Recent project*	60	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 310.00	$18,600
Topography survey/coring for cap thickness	*Recent project*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 40,000.00	$40,000
Site Restoration											
Wetland Restoration	*Alternatives Analysis*	0.33	acre	$ -	$ -	$ -	$ -	$ -	$ -	$106,200	$35,046
Tree Restoration	*Alternatives Analysis*	300	each	$ -	$ -	$ -	$ -	$ -	$ -	$ 737	$220,995
School property restoration (asphalt)	*Engineer's Estimate*	4,840	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 14	$67,760
School property pre and post remediation sampling	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$10,000
Walk behind Plate Compactor	*01 54 33.20 1300*	1	month	$ -	$ -	$ 2,073.92	$ 2,074	$ 259	$ 259	$ -	$2,333
Topsoil	*Recent quote- EnviroTrac*	860	lcy	$ 44.50	$ 38,263	$ -	$ -	$ -	$ -	$ -	$38,263
Finishing grading slopes, gentle	*31 22 16.10 3300*	5,423	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.25	$1,356
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	49	msf	$ -	$ -	$ -	$ -	$ -	$ -	$ 73.96	$3,610
Topographic Survey	*02 21 13 09 0020*	1.0	acre	$ 20.06	$ 20	$ 587.90	$ 588	$ 15	$ 15	$ -	$623
Fencing Installation (assume 90% re-used/installed)	*32 31 13.20 0800*	1,200	lf	$ 19.23	$ 2,308	$ 4.46	$ 5,352	$ 1	$ 1,368	$ -	$9,028
Mobilization and Demobilization											**$135,043**
7% of Total Costs of Site Work, Treatment										$1,929,179	$135,043
Contingency											**$1,035,802**
20% of Total Construction Activities										$5,179,010	$1,035,802
Professional/Technical Services											**$857,474**
5% Project Management										$5,043,967	$252,198.35
6% Remedial Design											$302,638.02
6% Construction Management											$302,638.02
LONG TERM MONITORING								**ANNUAL LTM COST (YRS 1-5)**			**$59,000**
								ANNUAL LTM COST (YRS 6-30)			**$30,000**
								LIFETIME LTM (NPV)			**$574,765**
Fill thickness monitoring											
											$29,216
Inspection of soil and subaqueous cover		8	hr	$ -	$ -	$ 85.00	$ 680	$ -	$ -	$ -	$680
Cap Stability Survey		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000	$20,000
Sediment and fish tissue sampling field effort		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000	$2,000
Sediment and fish tissue analysis		30	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 150	$4,500
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ 850.00	$ 850	$ 336	$ 336	$ -	$1,186
Reporting		10	hr	$ 85.00	$ 850	$ -	$ -	$ -	$ -	$ -	$850
Cap Repairs											$724
Mobilization/Demobilization		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$500
Supply and Transportation of NYS Certified Clean Back Fill Material, assume 20 x 20 area to be	*Recent quote- EnviroTrac*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.00	$204
Backfill FEL, minimal haul	*31 23 16.13 3020*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.53	$18
Compacting backfill, 12" lift, 2 passes w/ drum roller	*31 23 23.23 5060*	26	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.33	$2
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + LTM + Maintenance) — $7,647,000

Assumptions:

Working condition is Safety Level:		D	(Labor productivity:	100%	; Equipment productivity:	100%	)		
Weighted Average of city cost index (Long Island City, NY)		133.5%	(not applicable for costs der		$1				
Costs are loaded with a profit factor		10%							
Inflation		3%	per year						Labor
Estimated number of soil samples		69	samples	1	times sampled	0.25	hrs/sample	$85	Cost per hr
				20%	added for QA/QC samples	1	worker sampling		
Characterization Cost	Table A (per CWM)	$477.00	per sample						
Analytical cost	TAL Metals	$75.00	per sample						
For each sampling event, assumed:		$50	for materials (gloves, notebooks, etc.)						

Disposal

Cadmium contaminated soil as a "listed" waste- incineration	$390	per ton	392	tons soil/sediment hazardous			
			22	tons per load	18	loads for haz disposal	
Cadmium contaminated soil as non-haz	210	per ton	7,443	tons soil/sediment for non-haz disposal	338	loads for non-haz disposal	
					15	loads per day	
					20	working days per month	

Typical Rental Rates - Includes G&A and 10% Profit

Mini-Rae Survey Mode PID	$96.08	per day				
Truck/SUV (1/2 ton or smaller)	$70.74	per day	**Excavation**			
Horiba U-10 Water Quality Meter	$73.77	per day	392	tons soil/sediment hazardous, unamended		
Submersible Pump	$42.16	per day	5%	percent-haz		
2 in Pump Control Box	$72.27	per day	7,443	tons soil/sediment non-hazardous, unamended		
Generator: 110 V	$57.24	per day	95%	percent non-haz		
Level D PPE	$11.91	per day				
					8	hours per working day
Work day consists of:	8	hrs			3	months for site prep/restoration
					2	months loading
					5	Total site work

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet	Alternatives Analysis	Alternatives Analysis Report, Dzus Fasteners Site, AECOM, March 2016
sf	square feet		
msf	1,000 square feet		