

TABLES

TABLE 1
SOIL COC CLEANUP LEVELS
 Stericycle Kent Facility
 Kent, Washington

all concentrations in milligrams per kilogram (mg/kg)

Compound	CAS Number	MTCA Method C	MTCA Method A Industrial	Protective of Groundwater (@ 13 degrees C)	Soil Cleanup Level	Basis
Volatile Organic Compounds						
Benzene	71-43-2	2.39E+03	3.00E-02	2.74E-02	2.74E-02	Protection of groundwater
Vinyl Chloride	75-01-4	1.05E+04	--	1.67E-03	1.67E-03	Protection of groundwater
Semivolatile Organic Compounds						
Benzo(a)pyrene	50-32-8	1.80E+01	2.00E+00	2.33E+00	2.33E+00	Protection of groundwater
Benzo(b)fluoranthene	205-99-2	1.80E+02	--	2.95E+00	2.95E+00	Protection of groundwater
Chrysene	218-01-9	1.80E+04	--	9.55E+01	9.55E+01	Protection of groundwater
Inorganics						
Arsenic	7440-38-2	8.75E+01	2.00E+01	2.92E+00	7.30E+00	Natural background
Cyanide	57-12-5	2.10E+03	--	--	2.10E+03	Protection of direct contact
Total Petroleum Hydrocarbons						
TPH as gasoline	86290-81-5	--	3.00E+01 ¹	--	3.00E+01	Protection of direct contact
TPH as diesel	68334-30-5	--	2.00E+03	--	2.00E+03	Protection of direct contact
TPH as lube oil	---	--	2.00E+03	--	2.00E+03	Protection of direct contact

Notes:

1. = Gasoline range organics, benzene present
2. Values sourced from CLARC website 2018, <https://fortress.wa.gov/ecy/clarc/CLARHome.aspx>

Abbreviations:

- MTCA = Model Toxics Control Act
- CAS = Chemical Abstract Service
- COC = Constituent of concern
- TPH = Total petroleum hydrocarbons

**TABLE 2
GROUNDWATER COC CLEANUP LEVELS**

Stericycle Kent Facility
Kent, Washington

Compound	CAS Number	MTCA Method A Groundwater ¹	MTCA Method B Groundwater ¹	Surface Waters of the State of Washington ²	National Recommended Water Quality Criteria ³	National Toxics Rule ⁴	MTCA Method B Surface Water	Protective of Indoor Air	Area Background	Groundwater Cleanup Level	Basis
Volatile Organic Compounds (µg/L)											
Vinyl chloride	75-01-4	2.00E-01	2.90E-02	--	2.40E+00	2.00E+00	3.70E+00	2.80E-01	--	2.90E-02	Method B Groundwater
Inorganics (µg/L)											
Arsenic	7440-38-2	5.00E+00	5.83E-01	3.60E+01	1.80E-02	1.80E-02	9.82E-02	--	1.05E+01	1.05E+01	MTCA C Value ⁵
Iron	7439-89-6	--	1.12E+04	--	3.00E+02	--	--	--	2.45E+04	2.45E+04	MTCA C Value ⁵

Notes:

1. Values sourced from CLARC website 2018, <https://fortress.wa.gov/ecy/clarc/CLARHome.aspx>
2. WAC 173-201A – Acute and Chronic effects, Aquatic Life, Freshwater
3. Clean Water Act §304 – Freshwater, Acute and Chronic effects, Aquatic Life and for the Protection of Human Health, Consumption of Water and Organisms and Consumption of Organisms Only
4. 40 Code of Federal Regulations 131 – Freshwater, Acute and Chronic effects, Aquatic Life, and Human Health, Consumption of Water and Organisms
5. Method C values were selected for constituents where an area background value was calculated but the calculated value was higher than the Method C level, per WAC 173-340-706(1)(a)(i) and the approved Feasibility Study.

Abbreviations:

MTCA = Model Toxics Control Act
CAS = Chemical Abstract Service MTCA = Model Toxics Control Act
COC = Contaminant of concern

Table 3
Remediation Technologies Considered for Incorporation in Remedial Alternatives
Stericycle Kent Facility
Kent, Washington

General Response Actions	Remediation Technologies	Technology Description	Technology Development Status	General Performance Record	Site Areas Addressed	Site Contaminants Addressed	Site-Specific Issues Affecting Technology or Implementation	Rationale for Retention or Rejection	Screening Result
In Situ Physical/Chemical Treatment	Chemical Oxidation	Oxidation chemically converts hazardous contaminants to nonhazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, persulfate or permanganate. Reaction occurs only in aqueous solution.	Full-Scale	Technology demonstrated to be moderately effective under certain site conditions. Ineffective for most inorganics.	AOC-2, AOC-3, and AOC-4	VOCs, SVOCs, TPH	Handling of oxidant chemicals during remediation presents a safety concern. Chemical oxidant demand of soil can consume large quantities of oxidant (pilot test recommended). Establishing effective oxidant delivery system for even vadose zone distribution is difficult. Oxidants can mobilize some metals and may affect ongoing anaerobic biodegradation in the groundwater.	Not effective for some COCs, and high risk of mobilization of metals and cyanide. Very high cost of implementation compared to other technologies.	Reject
	Chemical Reduction	Reduction chemically converts hazardous contaminants to nonhazardous or less toxic compounds that are more stable, less mobile, and/or inert. The reducing agents most commonly used are ZVI, ferrous sulfide, and hydrogen sulfide. Reaction occurs only in aqueous solution.	Full-Scale	Technology demonstrated to be moderately effective under certain site conditions.	AOC-2, AOC-3, and AOC-4	VOCs, SVOCs, TPH, some inorganics	Handling of reducing chemicals during remediation presents a safety concern. Site groundwater chemistry is conducive to reductive processes, and the abundance of ferrous iron in site groundwater may prevent additional dissolution of inorganics to groundwater.	Not effective for all COCs in soil. Will immobilize some metals, and will enhance bioremediation conditions for organic COCs.	Retain
Containment	Cap/Surface Cover	Surface caps constructed of asphalt concrete, Portland cement concrete, or flexible membrane liners prevent direct exposure to soil contaminants, control erosion, and reduce infiltration of stormwater into the subsurface, reducing the leaching of COCs to groundwater.	Full-Scale	Proven effective for preventing surface exposure to buried waste and for reducing infiltration of surface water through waste, limiting leaching of COCs to groundwater.	AOC-2, AOC-3, and AOC-4	VOCs, SVOCs, TPH, inorganics	The site is already largely covered in impervious surfaces in AOC-2, AOC-3, and AOC-4.	Would be effective in preventing exposure of workers at the facility to contaminated soils, and could potentially reduce migration of COCs into groundwater at the shallow water-bearing unit.	Retain
Excavation/Off-Site Disposal	Excavation and Off-Site Disposal	Wastes exceeding site remediation goals are excavated and transported off site to an appropriate hazardous waste land disposal facility.	Full-Scale	Proven effective for all COCs.	Accessible soils in AOC-2, AOC-3, and AOC-4	VOCs, SVOCs, TPH, inorganics	Extensive shoring and support systems would be required for excavations near existing structures. Some impacted soils would likely remain in place due to the presence of existing structures/buildings.	Capable of addressing all contaminants in vadose zone soil at the site. Least administratively, logistically, and technically complex ex situ remediation technology. Potentially applicable to hot spots if site structures/buildings are removed.	Retain

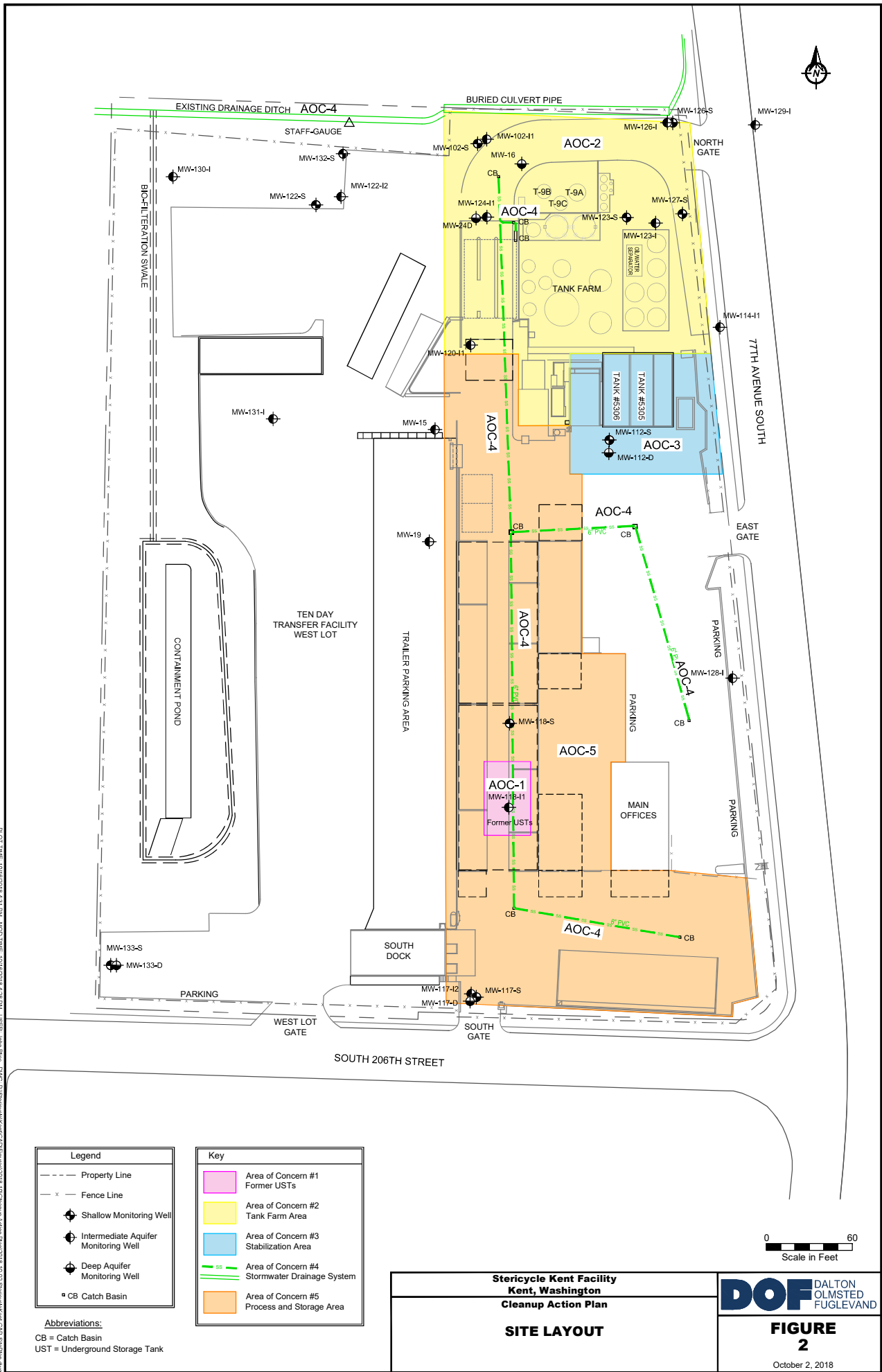
Table 3
Remediation Technologies Considered for Incorporation in Remedial Alternatives
Stericycle Kent Facility
Kent, Washington

General Response Actions	Remediation Technologies	Technology Description	Technology Development Status	General Performance Record	Site Areas Addressed	Site Contaminants Addressed	Site-Specific Issues Affecting Technology or Implementation	Rationale for Retention or Rejection	Screening Result
In Situ Biological Treatment	Enhanced Anaerobic Biodegradation	A carbohydrate (e.g., molasses, sodium lactate, or proprietary blend) is injected into the affected groundwater to serve as an electron donor for indigenous organisms to enhance reductive biodegradation or precipitation/stabilization of metals. The carbohydrate may be combined with ZVI for very low redox conditions.	Full-Scale	Proven effective under proper conditions for degradation of chlorinated organics and precipitation of metals.	AOC-2, AOC-3, AOC-5, and 10-Day Hazardous Waste Transfer Yard	Vinyl chloride, arsenic, iron, and hexavalent chromium.	Multiple injections of electron donor are typically required. Monitoring is required to confirm effectiveness.	May be useful to target small source areas for vinyl chloride and inorganics.	Retain
	Bioaugmentation	Injection of specially, nonindigenous microbes to enhance biodegradation. Microorganisms are commercially available for both aerobic and anaerobic degradation of chlorinated organics. Commercially available microorganisms may be used to assist in stabilization of inorganics.	Full-Scale	Has been effective for biodegradation of chlorinated solvents, sulfate reduction, and metals stabilization. Requires application of specific microbial seed. May require repeated application.	AOC-2, AOC-3, AOC-5, and 10-Day Hazardous Waste Transfer Yard	Vinyl chloride, arsenic, iron.	Nonindigenous organisms may not compete successfully with indigenous organisms. Vinyl chloride degradation is already occurring in groundwater. May be used in conjunction with enhanced biodegradation and in situ chemical reduction to address inorganics.	Bioaugmentation may be used if enhanced bioremediation is not meeting cleanup objectives for vinyl chloride and inorganics.	Retain
	Monitored Natural Attenuation	Intrinsic attenuation of groundwater constituents via the natural processes of biodegradation (aerobic and/or anaerobic), adsorption, and dilution. This passive technology relies on natural conditions within impacted groundwater.	Full-Scale	Has been proven effective at sites with appropriate conditions.	AOC-2, AOC-3, AOC-5, and 10-Day Hazardous Waste Transfer Yard	Vinyl chloride, arsenic, iron, cyanide, and hexavalent chromium.	Natural biodegradation of vinyl chloride is active at the site. Potentially longer remediation times when compared to more active technologies.	Natural attenuation is a viable process and has been documented to be actively occurring at the site.	Retain
In Situ Physical/Chemical Treatment	Chemical Reduction	A reducing chemical such as hydrogen sulfide, hydrogen-releasing compound, ferrous sulfide or ZVI is added to the groundwater to chemically precipitate contaminants. Usually applied through injection wells or via direct-push technology. Some chemicals formulated for chemical reduction also promote biological degradation, such as emulsified ZVI.	Full-Scale	Can be effective depending on aquifer chemistry, tightness of formation, and number of injections.	AOC-2, AOC-3, AOC-5, and 10-Day Hazardous Waste Transfer Yard	Arsenic, iron, cyanide, and hexavalent chromium. May augment biodegradation of vinyl chloride.	This technology would enhance naturally occurring anaerobic biodegradation occurring at the site. May be difficult to achieve effective reducing agent distribution in tight formations. Will immobilize all site COCs.	This technology has potential to immobilize all inorganic materials at the site under the appropriate geochemical conditions, and to accelerate the naturally occurring biodegradation of vinyl chloride.	Retain
	Chemical Oxidation	An oxidizing chemical (permanganate, hydrogen peroxide, Fentons Reagent, Peroxox) is added to the groundwater to chemically oxidize contaminants. Usually applied through injection wells or via direct-push technology.	Full-Scale	Can be effective depending on oxidant demand of native material, tightness of formation, and number of injections. Not effective for most metals. May result in metals mobilization.	AOC-2, AOC-3, and AOC-5	Vinyl chloride, may reduce soluble iron and free cyanide.	Active natural biological degradation of vinyl chloride would be inhibited by the addition of chemical oxidants. High reduced iron concentrations at the site would exert a large oxygen demand, affecting efficiency of treatment. May be difficult to obtain effective oxidant distribution in tight formations. May mobilize some metals.	Effective treatment may be limited due to the variable permeability in different groundwater zones and the high oxidant demand. May result in mobilization of reduced metals.	Reject
	Passive/Reactive Treatment Barriers	Contaminant concentrations in groundwater are reduced as the groundwater flows through the permeable reactive barrier containing ZVI.	Full-Scale	Has been effectively used to reduce all groundwater COCs.	AOC-2, AOC-3, AOC-5, and 10-Day Hazardous Waste Transfer Yard	Vinyl chloride, arsenic, iron, cyanide, and hexavalent chromium.	Would be difficult to build a passive/reactive barrier due to complex hydrogeology and seasonal groundwater flow fluctuations. Construction could interfere with activities at the facility.	May be useful in targeted locations or for contingency treatment if anaerobically biodegradable compounds or metals are recalcitrant.	Retain

Abbreviations:

- AOC = Area of Concern
- COC = Contaminant of concern
- SVOC = Semivolatile organic compound
- TPH = Total petroleum hydrocarbons
- VOC = Volatile organic compound
- ZVI = Zero-valent iron

FIGURES



PLOT TIME: 10/19/2018 4:31 PM; MOD TIME: 10/19/2018 4:29 PM; USER: csm; DWG: P:\Stericycle\KENT\CAD\DWG\10152018\10152018.dwg; PLOT: 10/19/2018 4:31 PM; PLOT: 10/19/2018 4:31 PM

0 60
 Scale in Feet

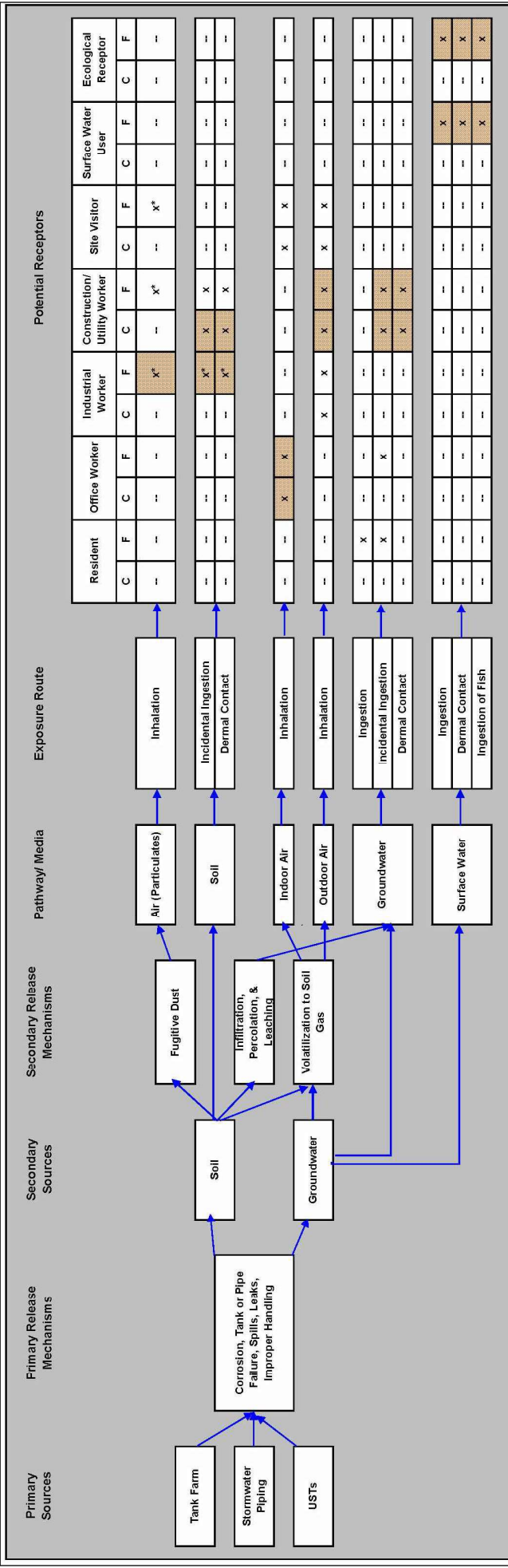
**Stericycle Kent Facility
 Kent, Washington
 Cleanup Action Plan**

SITE LAYOUT

DOF DALTON OLMSTED FUGLEVAND

FIGURE 2

October 2, 2018

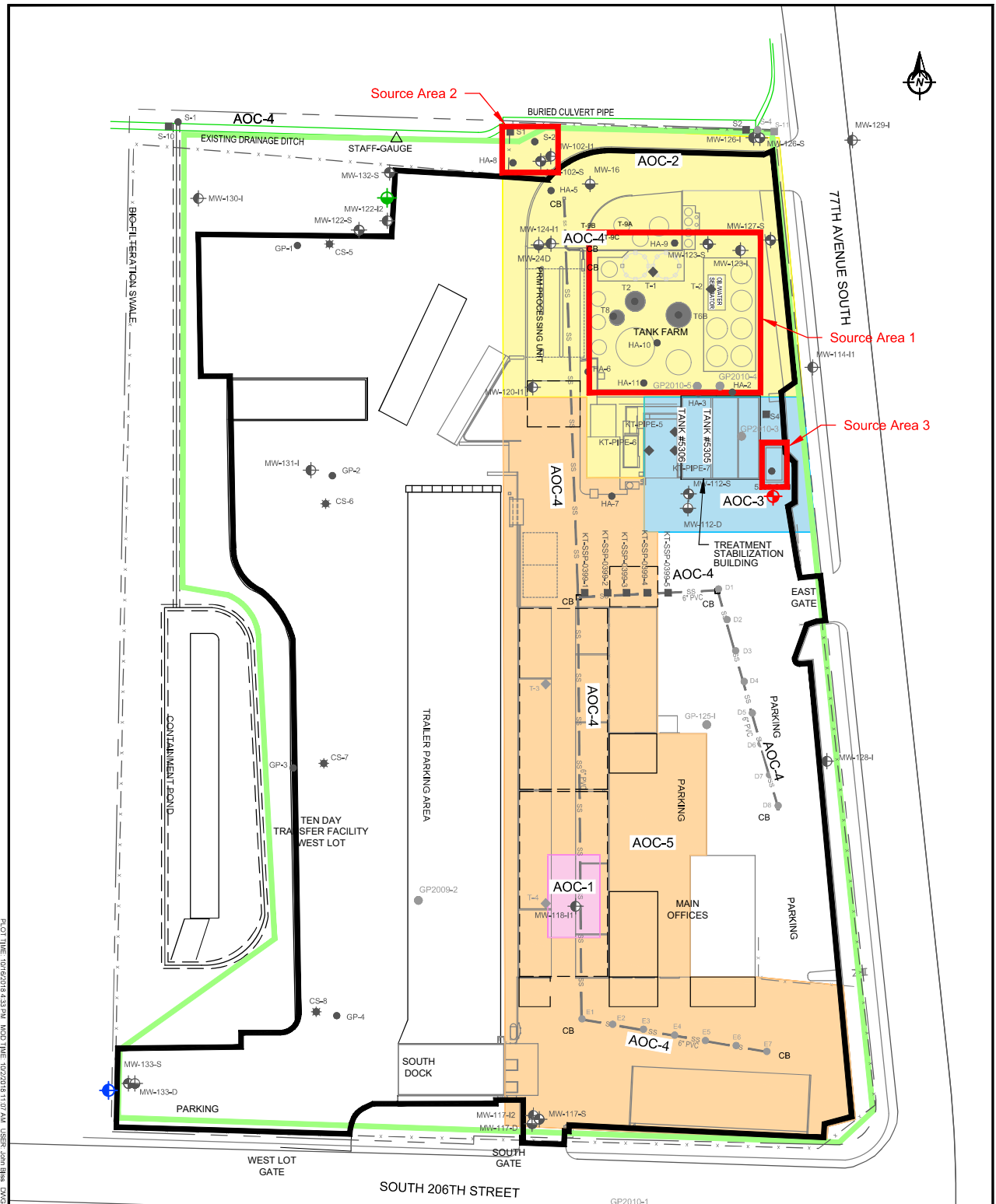


KEY

- ↑ Potential Transport or Exposure Pathway
- Incomplete Exposure Pathway
- X Potentially Complete Exposure Pathway
- X Most highly exposed receptor
- * Assumes cap removed in the future
- C Current land use
- F Future land use

USTs = Underground Storage Tanks

Note: Indoor air was considered a potentially complete pathway from contaminated soil or groundwater and therefore screening levels protective of this pathway were used in developing the FS.



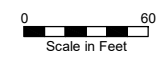
PLOT TIME: 10/16/2018 4:33 PM; MOD TIME: 10/20/2018 11:07 AM; USER: jcm; DWG: P:\Stericycle\Kent\DWG\CAD\CAD.dwg; PLOT DATE: 10/20/2018 11:07 AM; PLOT TIME: 10/20/2018 4:33 PM; MOD TIME: 10/20/2018 11:07 AM; USER: jcm; DWG: P:\Stericycle\Kent\DWG\CAD\CAD.dwg

Explanation	
	Extent of existing surface cap
	Approximate areas for soil remediation at facility closure
	Proposed New Shallow Monitoring Well
	Proposed New Intermediate Monitoring Well
	Proposed New Deep Monitoring Well

Legend	
	Property Line
	Fence Line
	Groundwater Monitoring Well
	Composite Soil Sample
	Soil Sample
	Catch Basin
	Stormwater Drainage System
	Conditional Point of Compliance

Key	
	Area of Concern #1 Former USTs
	Area of Concern #2 Tank Farm Area
	Area of Concern #3 Stabilization Area
	Area of Concern #4 Process and Storage Area

Abbreviations:
 CB = Catch Basin
 UST = Underground Storage Tank

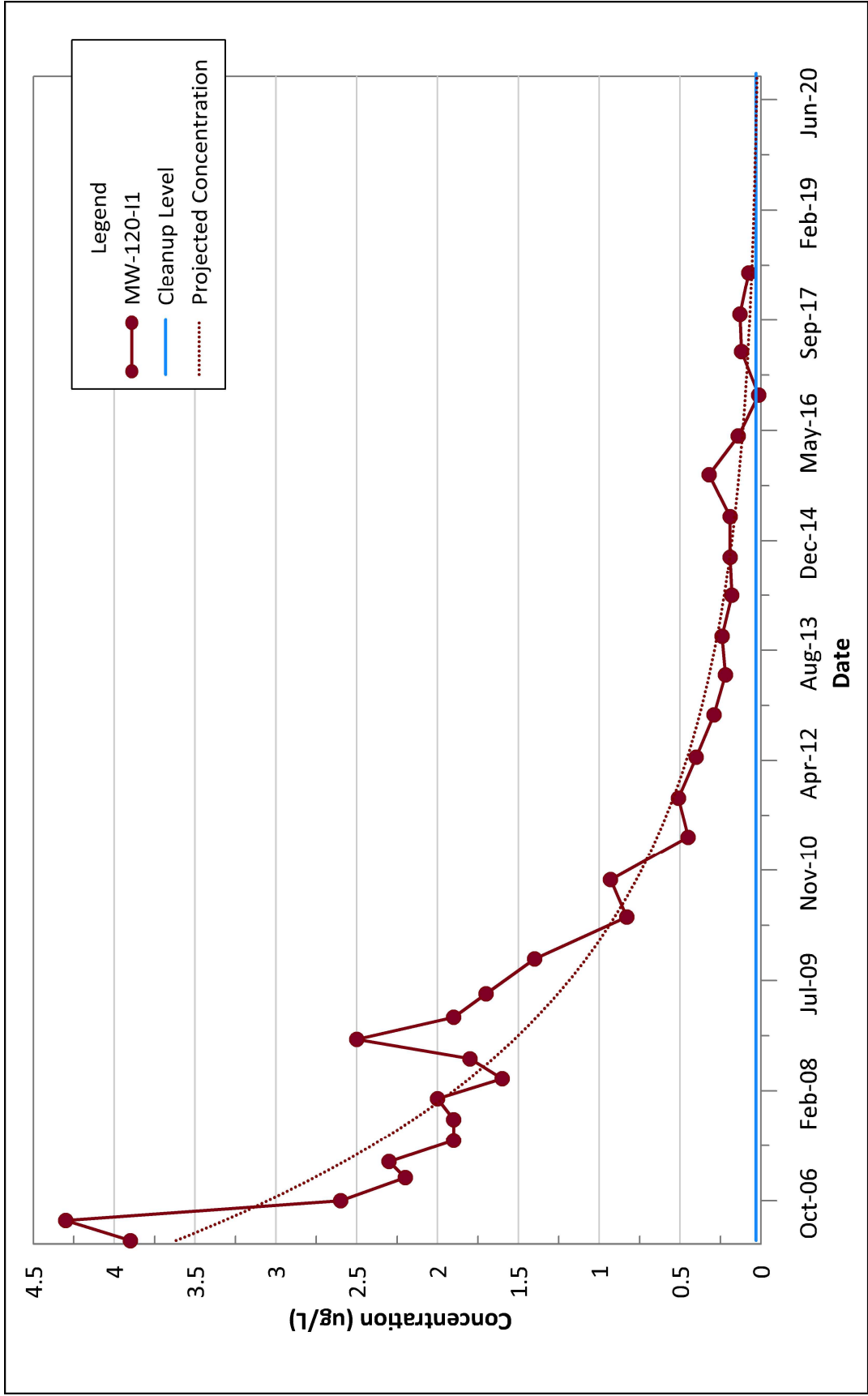


Stericycle Kent Facility
Kent, Washington
Cleanup Action Plan

PROPOSED CLEANUP ACTION

DOF DALTON
 OLMSTED
 FUGLEVAND

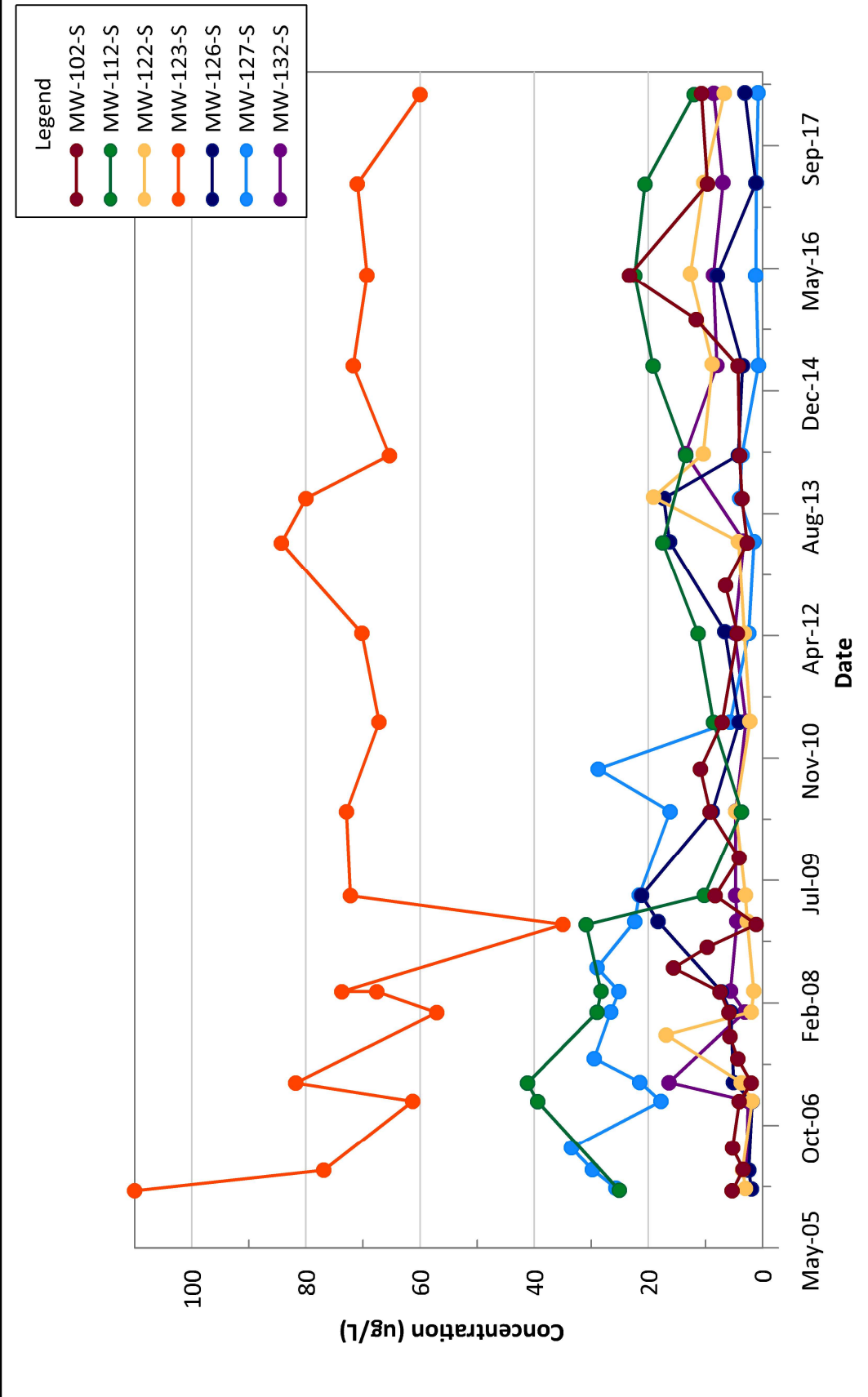
FIGURE 5
 October 2, 2018



Projected Vinyl Chloride Concentrations at MW-120-I1

Stericycle Kent Facility
Kent, Washington

Figure 6

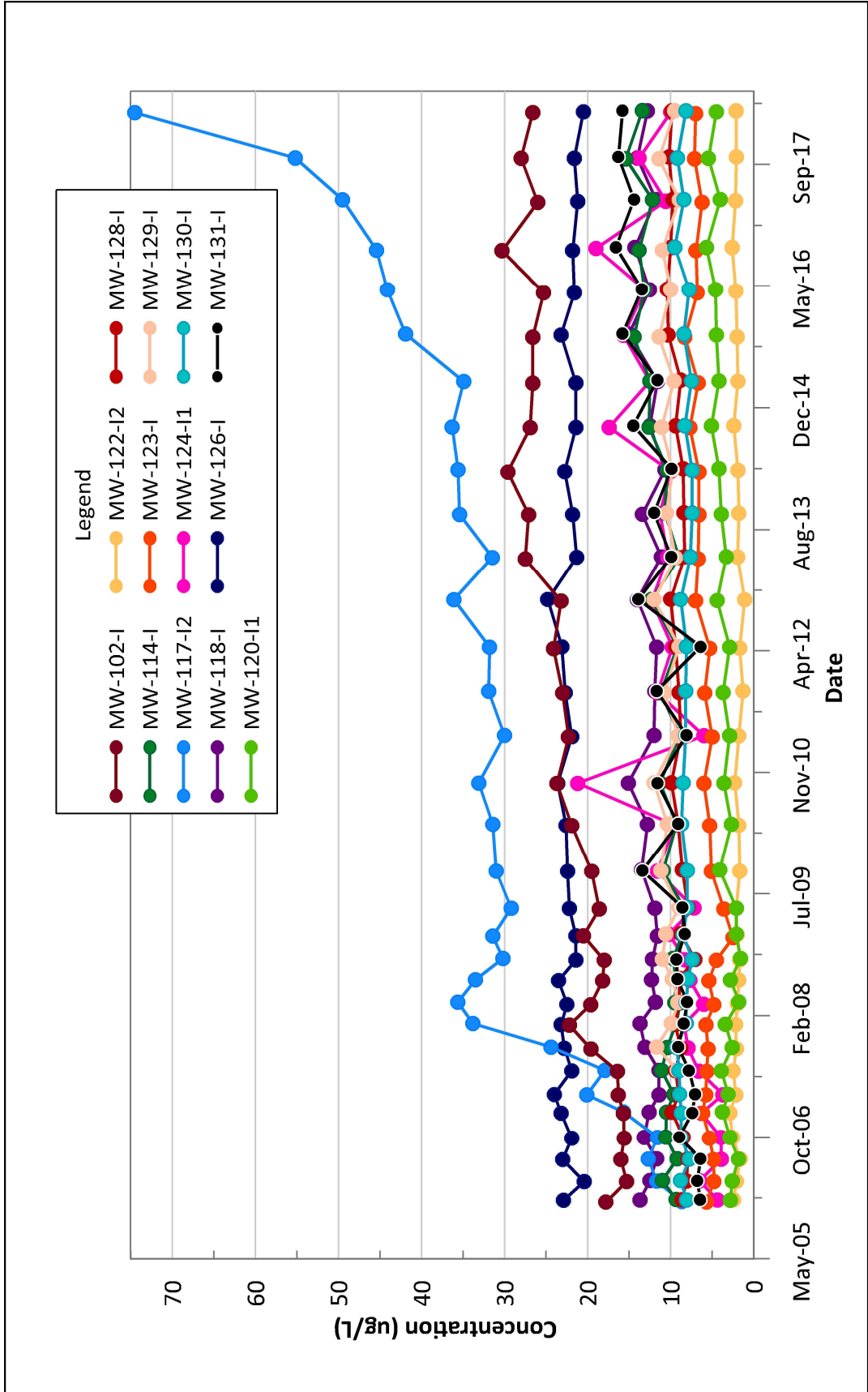


Total Arsenic Concentrations in Shallow Wells

2006 to 2018
 Stericycle Kent Facility
 Kent, Washington



Figure A-1



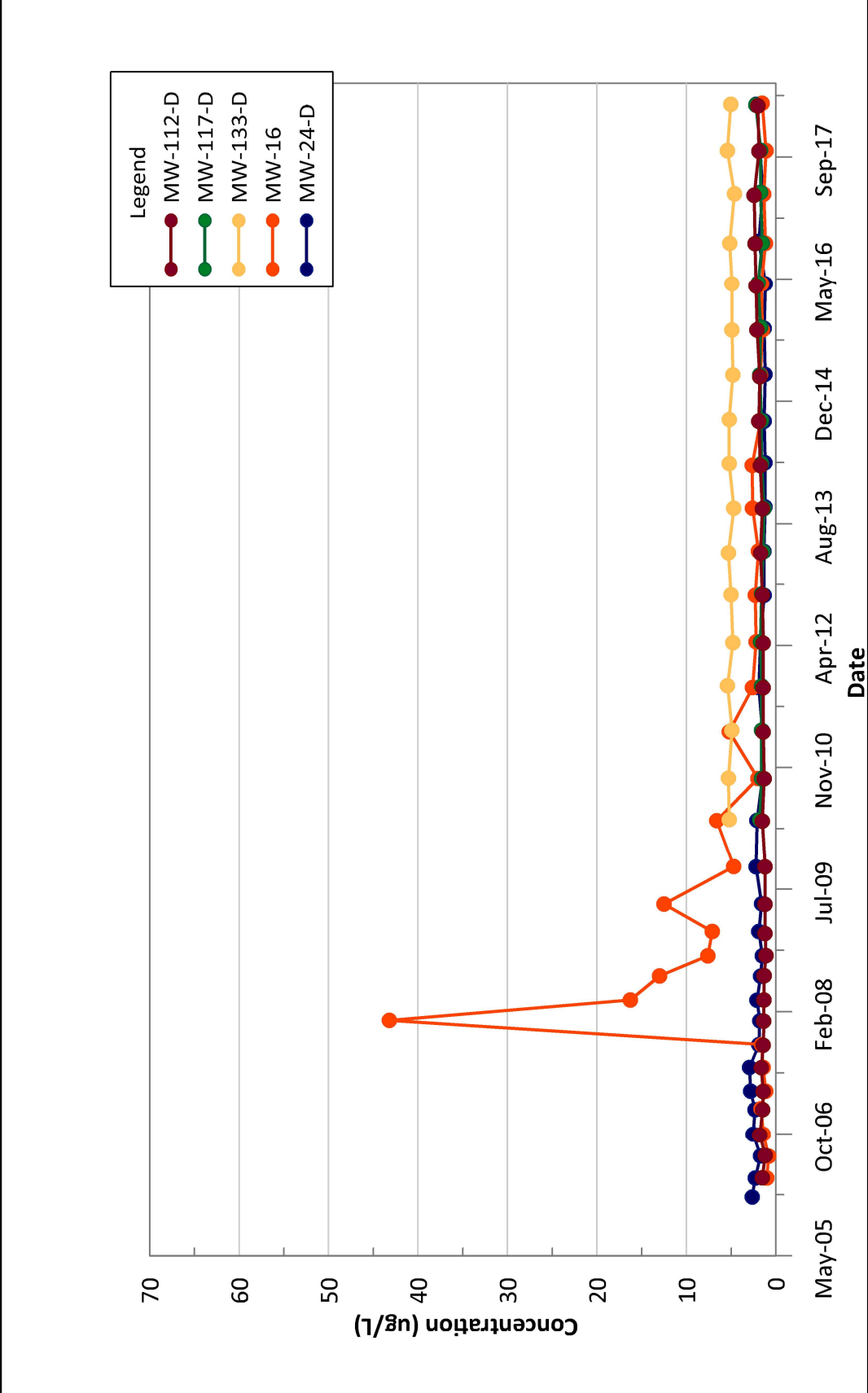
Total Arsenic Concentrations in Intermediate Wells

2006 to 2018

Stericycle Kent Facility
Kent, Washington



Figure A-2



Total Arsenic Concentrations in Deep Wells

2006 to 2018

Stericycle Kent Facility
Kent, Washington



Figure A-3

APPENDIX B
WELL CONSTRUCTION DETAILS
Stericycle Kent Facility
Kent, Washington

Well ID	Date Installed	Screened Interval (feet bgs) ¹	Total Depth of Well Screen (feet bgs)	Top of Seal (feet bgs)	Bottom of Seal (feet bgs)	Top of Sand Pack (feet bgs)	Bottom of Sand Pack (feet bgs)	First Unit Borehole Diameter (in inches) and Depth (in feet)	Second Unit Borehole Diameter (in inches) and Depth (in feet)	Well Diameter (inches)	Riser Type	Screen Type	Sand Type	Seal Type	Standpipe (SP) or Flush Mount (FM)
Current Monitoring Well Network															
Shallow Water-bearing Unit															
MW-102-S	11/20/2002	2.75 to 5.75	5.75	1.5	2.25	2.25	5.75	8.25"	NA ²	2	Schedule 40 PVC ³	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-112-S	2/1/2001	3.0 to 6.5	6.5	1	2.5	2.5	7	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-117-S	11/20/2002	2 to 4	4	1.5	2	2	4	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-122-S	11/20/2002	1.5 to 3.5	3.5	0.5	1	1	3.5	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-123-S	2/1/2001	3 to 6	6	1	2.5	2.5	6.5	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	SP
MW-126-S	11/22/2002	3 to 6	6	1.5	2.5	2.5	6	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-127-S	11/20/2002	3 to 8	8	1.5	2.5	2.5	8	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-132-S	11/20/2002	1.5 to 4	1.5	0.5	1	1	4	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-133-S	1/7/2010	3 to 8	8.0	1.5	2.5	2.5	8.5	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#10/20	Bentonite chips	FM
Intermediate Aquifer															
MW-102-I	2/8/2001	13.5 to 18.5	18.5	2	12.5	12.5	19	14.25" to 5.5'	8.25" from 5' to 19.0'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	SP
MW-114-I	2/4/2001	11.5 to 13.5	13.5	1	11	11	14	14.25" to 5'	8.25" from 5' to 15.0'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-117-I	2/6/2001	14 to 19	19	1	13	13	19.5	14.25" to 5'	8.25" from 5' to 19.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-118-I	1/30/2001	13.5 to 16	16	1	13	13	16.5	14.25" to 9'	8.25" from 9' to 17.0'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-120-I	2/12/2001	12 to 17	17	1	11.5	11.5	17.5	14.25" to 6'	8.25" from 6' to 17.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-124-I	2/8/2001	12 to 16.5	16.5	1	11.5	11.5	17	14.25" to 6'	8.25" from 6' to 18'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-129-I	6/15/2007	11 to 16	16	1	3	3	16	2	NA	1	Schedule 40 PVC	Pre-pack Schedule 40 PVC, 0.010"-slot, #20/40 sand	#2/12	Bentonite chips	FM
MW-131-I	11/19/2002	8.5 to 13.5	13.5	2	8	8	14.5	14.25" to 4.5'	8.25" from 4.5' to 14.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM

APPENDIX B
WELL CONSTRUCTION DETAILS
Stericycle Kent Facility
Kent, Washington

Well ID	Date Installed	Screened Interval (feet bgs) ¹	Total Depth of Well Screen (feet bgs)	Top of Seal (feet bgs)	Bottom of Seal (feet bgs)	Top of Sand Pack (feet bgs)	Bottom of Sand Pack (feet bgs)	First Unit Borehole Diameter (in inches) and Depth (in feet)	Second Unit Borehole Diameter (in inches) and Depth (in feet)	Well Diameter (inches)	Riser Type	Screen Type	Sand Type	Seal Type	Standpipe (SP) or Flush Mount (FM)
Current Monitoring Well Network															
Intermediate Aquifer															
MW-122-I2	2/7/2001	15.5 to 20.5	20.5	1	12.5	15	20.5	14.25" to 5.5'	8.25" from 5.5' to 21.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	SP
MW-123-I	1/31/2001	21 to 26	26	1	20	20	26.5	14.25" to 8.5'	8.25" from 8.5' to 26.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	SP
MW-126-I	11/22/2002	20.5 to 25.5	25.5	2	20	20	26.5	14.25" to 6.5'	8.25" from 6.5' to 26.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	NA
MW-128-I	11/22/2002	21.5 to 26.5	26.5	2	21	21	29.5	14.25" to 5.5'	8.25" from 5.5' to 27.5'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-130-I	11/19/2002	18.5 to 22	22	2	18	18	23	14.25" to 6'	8.25" from 6' to 23'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	SP
Deep Aquifer															
MW-16	3/7/1990	33.3 to 38.3	38.5	2	31.7	31.7	40.3	14.25" to 4'	8.25" from 4' to 50'	2	Schedule 40 PVC	Schedule 40 PVC, 0.20"-slot	#2/12	Bentonite chips and grout	FM
MW-112-D	2/5/2001	38.5 to 43.5	43.5	1	37.5	37.5	44	14.25" to 7'	8.25" from 7' to 44'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips and grout	FM
MW-117-D	1/8/2010	37 to 42	42	3	36	36	45	14" to 3"	8.25" from 35' to 42'	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#10/20	Bentonite chips	FM
MW-24D	6/28/2000	29 to 39	39	2.5	27	27	39	8.25"	NA	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#2/12	Bentonite chips	FM
MW-133-D	1/7/2010	27.75 to 38	38	3	26.5	26.5	38	14" to 3"	8.25" from 26' to 38"	2	Schedule 40 PVC	Schedule 40 PVC, 0.10"-slot	#10/20	Bentonite chips	FM

Abbreviations
bgs = Below ground surface
NA = Not available
PVC = Polyvinyl chloride