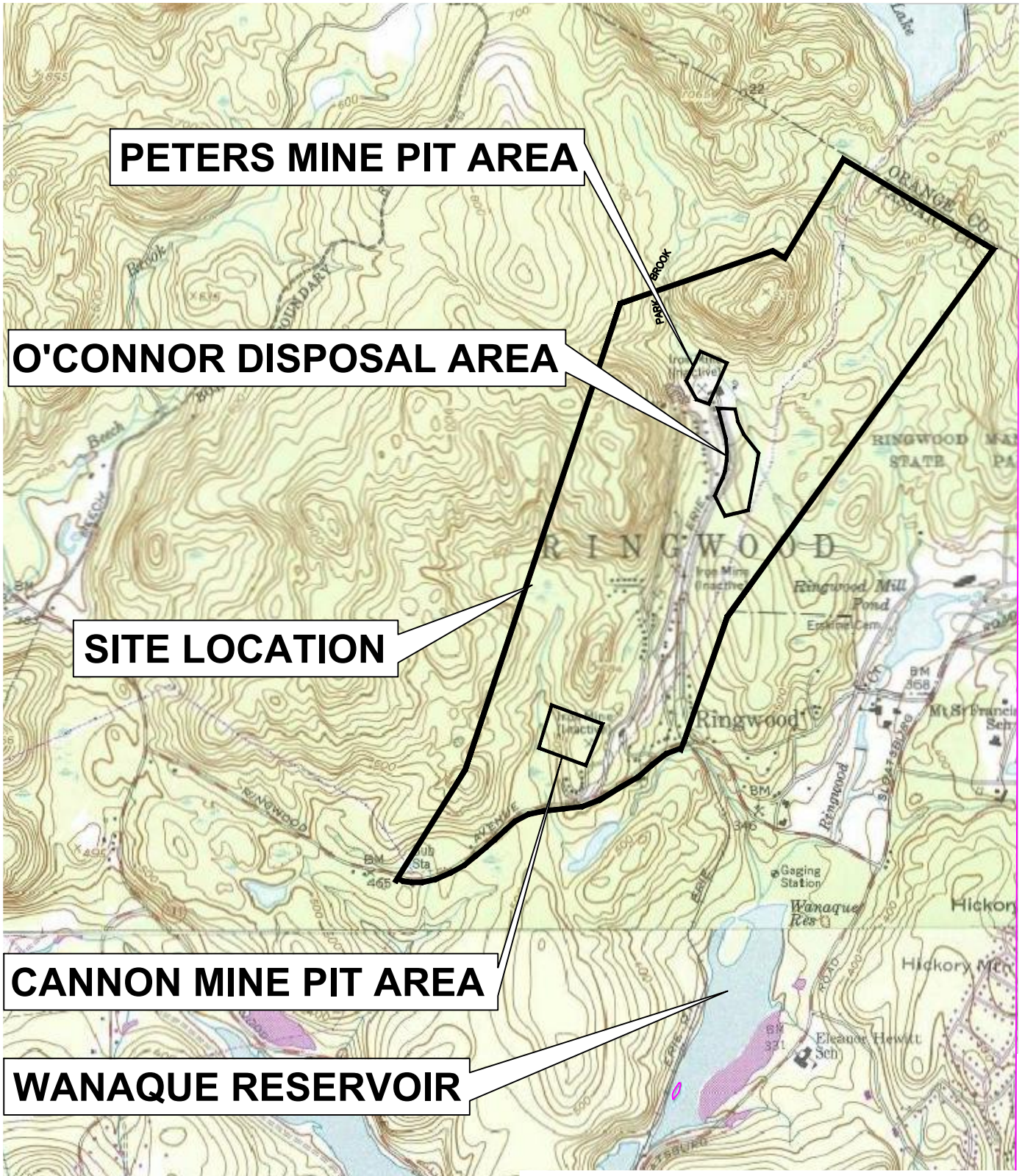

REFERENCE: WANAQUE, NJ AND GREENWOOD LAKE, NY–NJ, USGS QUADRANGLE, 7.5 MINUTE SERIES, 1995 AND 1954.

0 2000
SCALE IN FEET

LEGEND:

SITE BOUNDARY

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE LOCATION

ARCADIS

FIGURE
1

377399

CITY:MAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ0006042013\00035\2014-02\GW\FIG-01 - SITE LOCATION MAP.dwg
LAYOUT: 1 SAVED: 2/28/2014 2:44 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 2/28/2014 2:44 PM BY: WASILEWSKI, MATT
XREFS: IMAGES: 00604X01.JPG GREENWOOD-NJ.TIF Ring0001.JPG PROJECTNAME: ---

CANNON MINE PIT AREA

PETERS MINE PIT AREA

Boro□g□
Re□y□ling Center

Cooper Mine Pit

SR-13

St. George Pit*

Miller (New Miller) Pit*

S□aft*

Miller Pit*

New London Pit

Cannon Pit

Red Pit

Little Bl□e Pit*

Cannon Mine Air S□aft

SR-6

SR-15

SR-5

Peters Mine Pit

Peters Mine Air S□aft

SR-3

SR-4

Historic Mine Structure

SR-10

SR-□

SR-1

Hope Shaft

Hope Pit

SR-12

SR-8

Oa□ Pit

SR-2

SR-11

SR-9

Keeler Mine Pit*

Miller Mine Shaft

Hard Pit

Mule Pit

Blue Pit

SR-16

SR-14

Borough Hall

Br□s□-Ward
(New or Wood) Pits

O'CONNOR DISPOSAL AREA AS DEFINED IN THE 1988 REMEDIAL INVESTIGATION

BOROUGH OF RINGWOOD FORMER LANDFILL AREA

O'CONNOR DISPOSAL AREA AS DEFINED BY 1961/1974 TOPOGRAPHIC OVERLAY MAP

Shooting Range

Wanaque Resevoir

Sally's Pond
a□a
Ringwood Mill Pond

NEW JERSEY
NEW YORK

0 400 800 1200
SCALE IN FEET

LEGEND

- TREELINE
- TRAILS
- ROADWAYS
- SURFACE WATER
- RINGWOOD STATE PARK BOUNDARY
- BUILDINGS
- TRANSMISSION LINE TOWER
- UTILITY POLE
- FORMER TEST PIT LOCATION
- FORMER MINE SHAFT ENTRANCE
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING

Re□isions		
No.	Date	By
1	2/2 /2014	P. Ma□□laroli

Ringwood Mines/Landfill Site
Ringwood, New Jersey
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SITE LAYOUT

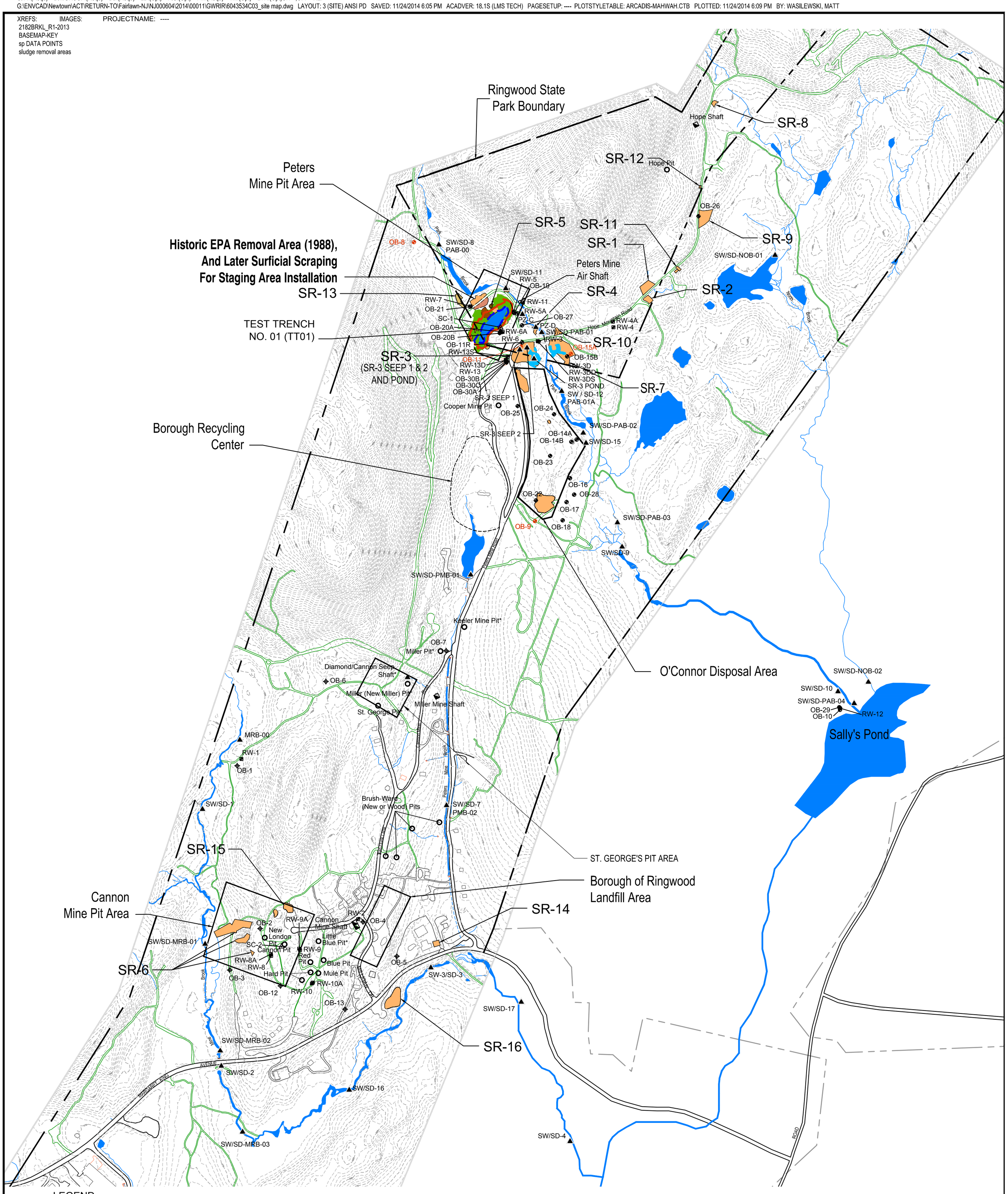
ARCADIS

FIGURE
2

Key: CITY=offi e lo ation DIV/GROUP=di □or gro p DB=drawn□y LD=lead drafter PIC=Prin ipal in C arge PM=Pro e t Manager TM=Tas □Manager/Req estor LYR=layer settings(t rn all on, t en t rn all REF off)
CITY: (MAHWAH) SYRACUSE, NY GROUP: ENVCAD DB: (J G ON ALE□), P. LISTER LD: (J G ON ALE□) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACTNU\00060420130003\2014-02\GWFIG-02 SITE LAYOUT.dwg LAYOUT: 2 SAVED: 2/2 /2014 2:56 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 2/2 /2014 2:5 PM BY: GON ALE□, JAMES
XREFS: IMAGES: PROJECTNAME: ----
si dge re o al areas

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00011\GWRIR\6043534C03_site map.dwg LAYOUT: 3 (SITE) ANSI PD SAVED: 11/24/2014 6:05 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 11/24/2014 6:09 PM BY: WASILEWSKI, MATT

XREFS: IMAGES: PROJECTNAME: ----
2182BRKL_R1-2013
BASEMAP-KEY
sp DATA POINTS
sludge removal areas



LEGEND

- BEDROCK WELL
- DEEP BEDROCK WELL
- DIRECTIONAL WELL
- UNCONSOLIDATED WELL
- MONITORING WELL DAMAGED OR NOT AVAILABLE FOR SAMPLING
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE PIT (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- SW/SD-2 ▲ SURFACE WATER AND SEDIMENT – SAMPLE LOCATION
- SW/SD-MRB-01 ▲ SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM MINE BROOK
- SW/SD-PMB-01 ▲ SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
- SW/SD-NOB-01 ▲ SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM NORTH BROOK
- SW/SD-PAB-01 ▲ SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
- TRAIL/ DIRT ROAD
- STREAM
- INFERRED STREAM
- TOP OF SLOPE TO MINE PIT WITHIN PETERS MINE PIT, ELEVATION 525 FT MSL (1961)
- TOP OF BEDROCK PIT WITHIN PETERS MINE PIT

NOTE:
EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

0 400' 800'
GRAPHIC SCALE

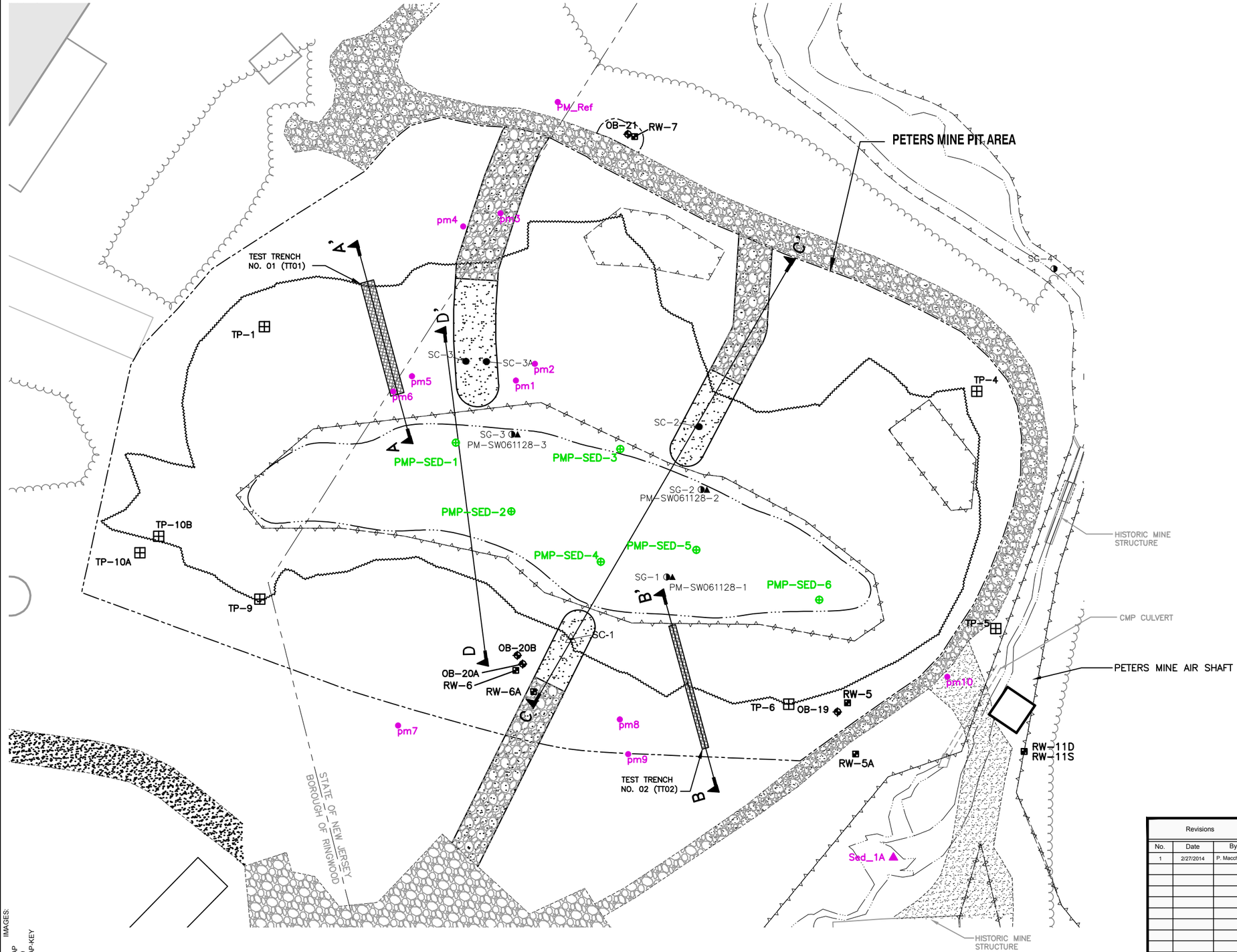
Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

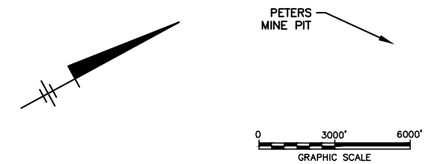
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE PLAN DEPICTING TOPOGRAPHIC FEATURES

ARCADIS

FIGURE
3





LEGEND:

- EXISTING CONTOUR
- ESTIMATED EXTENT OF HISTORIC FILL
- EXISTING SPOT ELEVATION
- LIMITS OF PETERS MINE PIT INVESTIGATION AREA
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- TREE LINE
- WETLAND BOUNDARY BY TRIDENT
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- TEST TRENCH LOCATION
- PMP-SED-1 — 2011 SEDIMENT SAMPLING LOCATIONS
- PM-SW061128-1 — HISTORICAL SURFACE WATER SAMPLE LOCATION
- pm8 — USEPA SOIL SAMPLE
- Sed_1A — USEPA SEDIMENT SAMPLE
- SC-2 — SOIL BORING
- OB-19 — OVERBURDEN MONITORING WELL
- SG-1 — STAFF GAUGE
- RW-5 — BEDROCK MONITORING WELL
- TP-6 — INVESTIGATION TEST PIT
- SC-1 — DIRECTIONAL MONITORING WELL
- USEPA — UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
- PMP — PETERS MINE PIT AREA
- 601 — BLOCK
- 12 — LOT
- DRILLING PAD
- A — A' CROSS-SECTION CALLOUT

NOTES:

1. WETLAND BOUNDARY ESTABLISHED BY TRIDENT ENVIRONMENTAL CONSULTANTS (2005).
2. EXTENT OF HISTORICAL FILL ESTIMATED FROM 1961 AND 1974 COMPARISON FIGURE.

0 30' 60'
GRAPHIC SCALE

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

Ringwood Mines/Landfill Site
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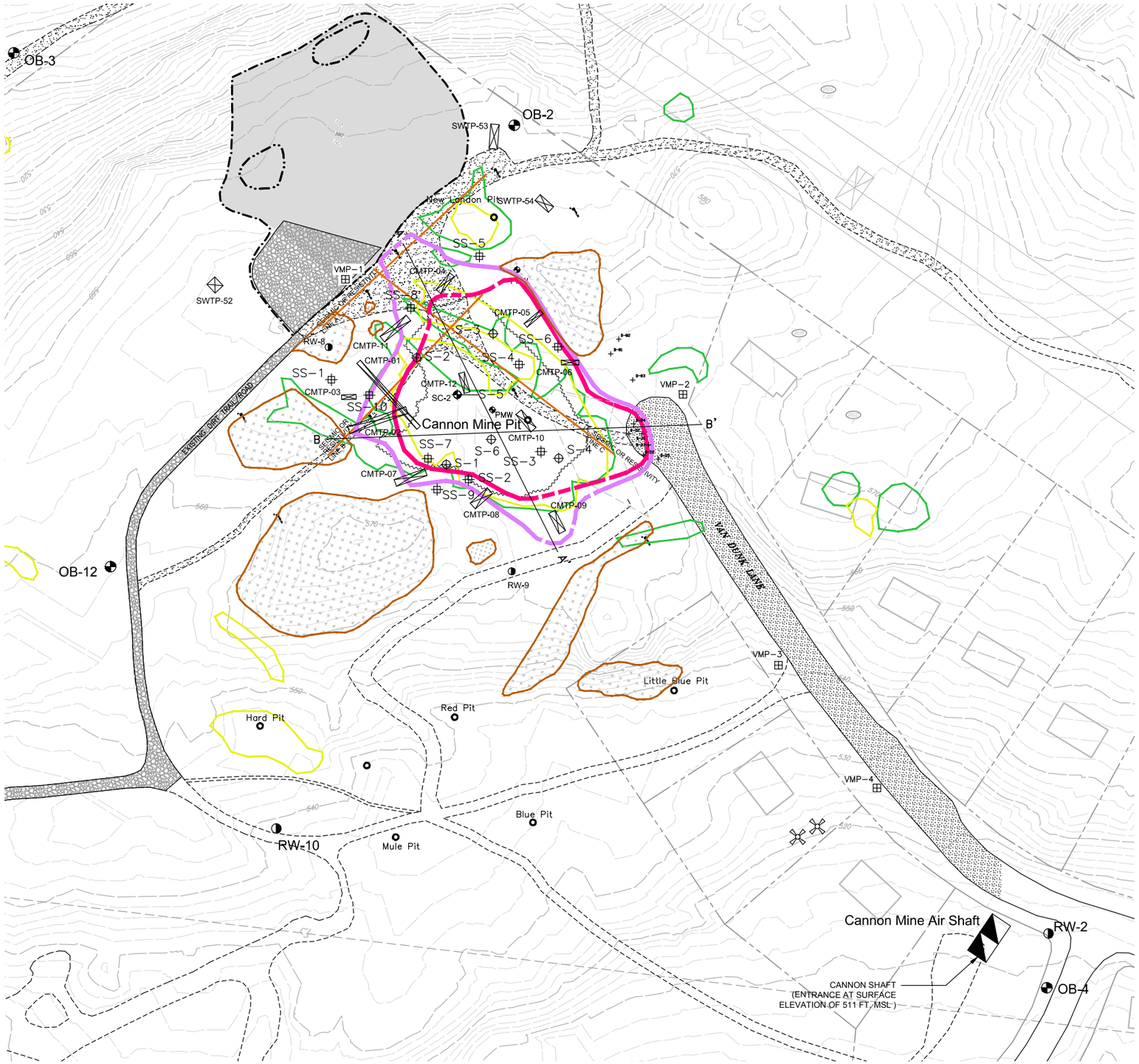
PMP AREA SAMPLE LOCATION MAP

ARCADIS

FIGURE
4

CITY:MAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newborn\ACT\RETURN-TO\Fairlawn-NJ\NJ0006043\2013\0003352014-02\GW\FIG-04 - PMP SAMPLE LOCATION MAP.dwg LAYOUT: 4 SAVED: 1/24/2013 12:19 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 2/28/2014 10:45 AM BY: WASILEWSKI, MATT
XREFS: BASEMAP NGVD29 BASEMAP-KEY IMAGES:



LEGEND:

VMP–1	VIBRATION MONITORING LOCATION
530	EXISTING CONTOUR
	PROPERTY BOUNDARY
	ESTIMATED EXTENT OF HISTORIC FILL
	STABILIZED CONSTRUCTION LOAD–OUT AREA
	CONCENTRATED PAINT SLUDGE REMOVAL AREA
	PAVED ROAD
	EXISTING DIRT TRAIL/ROAD
	VISIBLE PITS IN 1940 AERIAL PHOTO
	VISIBLE PITS IN 1961 AERIAL PHOTO
	LOCATION OF SMALL SINK HOLES
	ROCK OUTCROP
OB–1	EXISTING OVERBURDEN MONITORING WELL
RW–8	EXISTING BEDROCK MONITORING
S–1	VERTICAL SONIC BORING LOCATION
SS–1	SURFACE SOIL SAMPLE LOCATION
CMTP–03	TEST PIT LOCATION
FT. MSL.	FEET ABOVE MEAN SEA LEVEL
	5' INTERPOLATED DEPTH TO BEDROCK OR BLAST RUBBLE (DASHED WHERE INFERRED)
	14' INTERPOLATED DEPTH TO BEDROCK OR BLAST RUBBLE (DASHED WHERE INFERRED)
A ——— A'	CROSS–SECTION TRANSECT LINE

NOTES:

1. SUBSURFACE MINE STRUCTURE LOCATIONS ARE APPROXIMATE.
2. ONLY THE TWO MOST SHALLOW MINE LEVELS (LEVELS 1 AND 2) HAVE BEEN SHOWN SINCE THEY INTER–CONNECT WITH THE CANNON MINE PIT AND OTHER PITS IN THIS AREA, AND ARE THE MOST LIKELY TO BE OF CONCERN.

0 60
SCALE IN FEET

Revisions		
No.	Date	By
1	2/2 /2014	P. Ma ; ; lanoli

Ringwood Mines/Landfill Site
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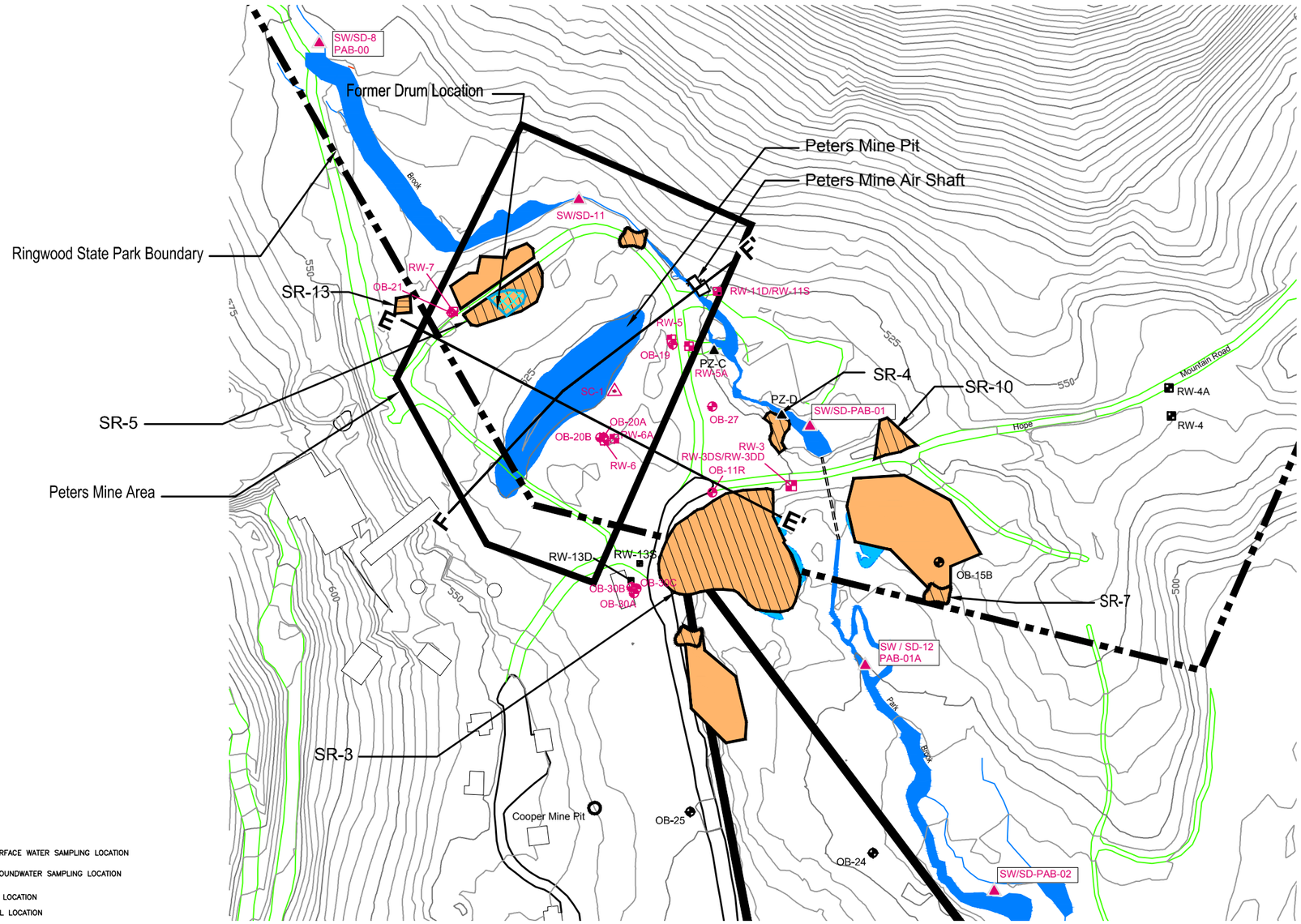
SR-6 AND CANNON MINE GEOPHYSICAL INVESTIGATION

ARCADIS

FIGURE
5

CITY:MAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PC:(Opt) PM:(Read) TM:(Opt) LYR:(Opt)ON*;OFF=REF*
OTS:NONE,NONE,NONE,



LEGEND

- SUPPLEMENTAL RI SURFACE WATER SAMPLING LOCATION
- SC-1 SUPPLEMENTAL RI GROUNDWATER SAMPLING LOCATION
- DEEP BEDROCK WELL LOCATION
- UNCONSOLIDATED WELL LOCATION
- DIRECTIONAL WELL LOCATION
- PETERS MINE SHAFT
- PAINT SLUDGE REMOVAL AREA
- 2006 – 2009 PAINT SLUDGE REMOVAL AREA (SR–3 THRU SR–9)
- CURRENT PAINT SLUDGE REMOVAL AREA (SR–13)
- SUBSURFACE DRUM OR DRUM REMNANTS
- DIRT ROAD
- E —— E' LINE OF GEOLOGIC CROSS SECTION (SEE FIGURE 3)

NOTE:
EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

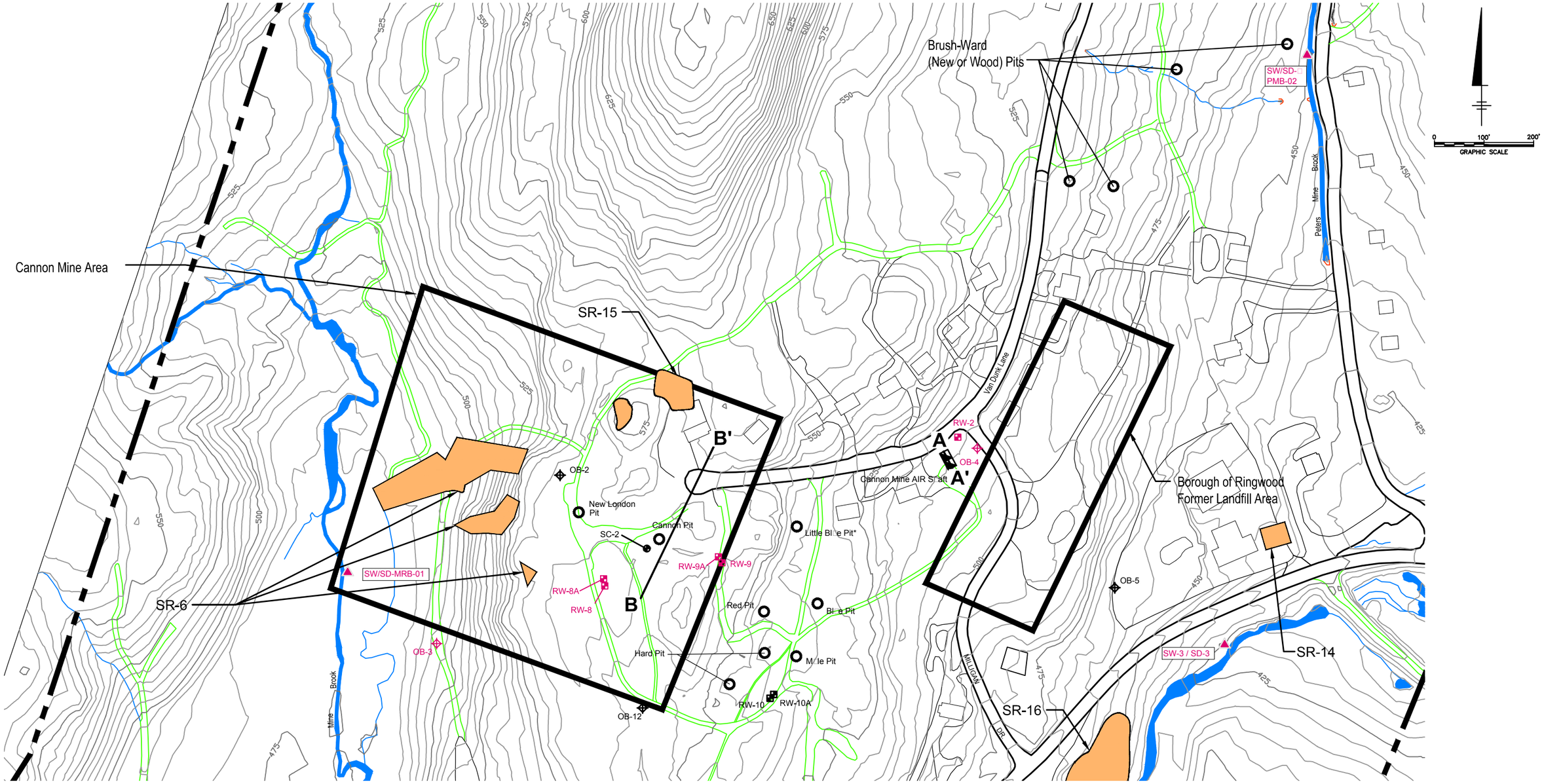
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SUPPLEMENTAL GROUNDWATER RI WELL NETWORK PMP

ARCADIS

FIGURE
6

CITY:NAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ00608\4\2014\00011\GWRI\RIFIG-06 SUPPLEMENTAL RI WELL NETWORK - PMP.dwg LAYOUT: 6 SAVED: 11/24/2014 10:01 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-RINGWOOD.CTB PLOTTED: 11/25/2014 7:57 AM BY: WASILEWSKI, MATT
XREFS: 2'&2BRKL_R1-2013 XSE-CONTOURS contours-svsd14 IMAGES: PROJECTNAME: ----



LEGEND

- DEEP BEDROCK WELL LOCATION
- UNCONSOLIDATED WELL LOCATION
- DIRECTIONAL WELL LOCATION
- Cannon — ABANDONED MINE PIT
- Cannon Mine Shaft — ABANDONED MINE SHAFT ENTRANCE
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- DIRT ROAD
- BEDROCK WELL LOCATION
- SUPPLEMENTAL RI SURFACE WATER SAMPLING LOCATION
- SUPPLEMENTAL RI GROUNDWATER SAMPLING LOCATION
- A—A' — LINE OF GEOLOGIC CROSS SECTION (SEE FIGURES 5 AND 6)

NOTE:
EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

Revisions		
No.	Date	By
1	2/2 /2014	P. Ma[illegible]lardi

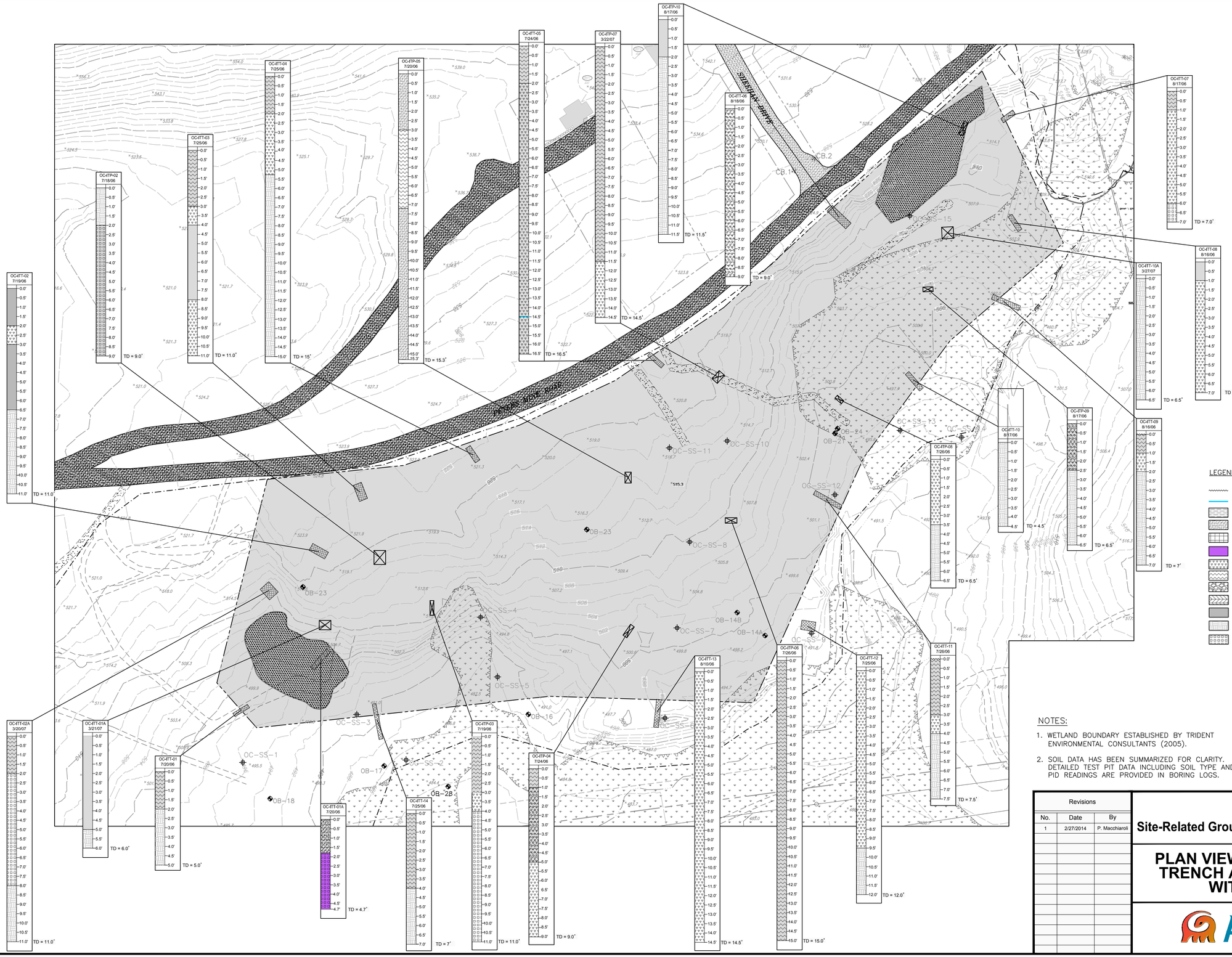
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SUPPLEMENTAL GROUNDWATER RI WELL NETWORK CANNON MINE AREA

ARCADIS

FIGURE
7

CITY:MAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACTN\00604\2013\00035\2014-02\GW\FIG-10 SUPPLEMENTAL RI WELL NETWORK - CMP.dwg LAYOUT: 10 SAVED: 2/27/2014 2:46 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-RINGWOOD.CTB PLOTTED: 2/27/2014 2:49 PM BY: GONZALEZ, JAMES
XREFS: 21623BRKL_R1-2013 IMAGES: sludge removal areas PROJECTNAME: ----



LEGEND:

- EXISTING SPOT ELEVATION
- EXISTING ELEVATION CONTOUR
- CENTERLINE OF STREAM AS FIELD SURVEYED BY GEOD
- OVERHEAD UTILITY LINES
- TRAIL
- WETLAND BOUNDARY (TRIDENT)
- O'CONNOR INVESTIGATION AREA
- LIMIT OF O'CONNOR SURVEY AREA
- TEST PIT LOCATION
- TEST TRENCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- OVERBURDEN WELL LOCATION

0 60 120 180
SCALE IN FEET

SUMMARY LOG:

TEST PIT ID
EXCAVATION DATE
DEPTH (FEET BELOW GROUND SURFACE)
TOTAL DEPTH OF TEST PIT

LEGEND:

- SURFACE REFUSE
- WATER LEVEL
- CLAY
- SAND
- SILT
- PAINT SLUDGE
- MINE TAILINGS
- REFUSE
- COBBLES
- ORGANIC MATERIALS
- FILL MATERIAL
- NATIVE SOIL
- MINE WASTE ROCK

NOTES:

1. WETLAND BOUNDARY ESTABLISHED BY TRIDENT ENVIRONMENTAL CONSULTANTS (2005).
2. SOIL DATA HAS BEEN SUMMARIZED FOR CLARITY. DETAILED TEST PIT DATA INCLUDING SOIL TYPE AND PID READINGS ARE PROVIDED IN BORING LOGS.

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

Ringwood Mines/Landfill Site
Ringwood, New Jersey

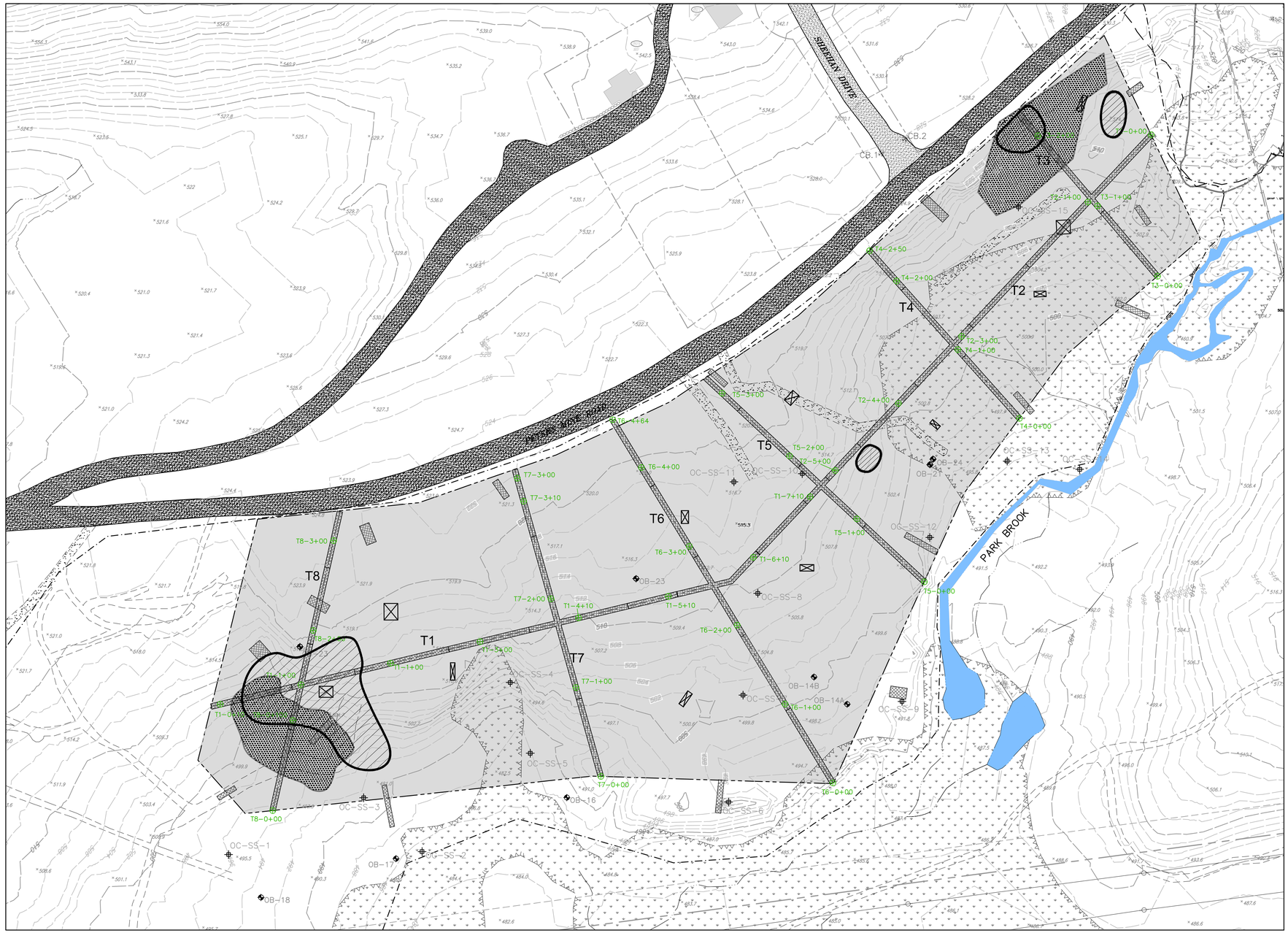
Site-Related Groundwater Remedial Investigation Report

PLAN VIEW OF FORMER OCDA TEST TRENCH AND TEST PIT LOCATIONS WITH SUMMARY LOGS

ARCADIS

FIGURE
8A

CITY:()NEWTOWN, PA\ SYRACUSE, NY DIV/GROUP: ENV/IM-DV DB:(M. WASILEWSKI),P. LISTER PM/TM/TR: J. ROCKLIN LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\Newtown\ACT\RETURN-TO\Farleftown-NJN\J00060\4\20130000352014-02\GWFIG-08A OCDA Plan View Of TTs & TPs Logs.dwg LAYOUT: 8A SAVED: 2/28/2014 10:51 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 2/28/2014 10:52 AM BY: WASILEWSKI, MATT
IMAGES: PROJECTNAME: -----



LEGEND:

- EXISTING SPOT ELEVATION
- EXISTING ELEVATION CONTOUR
- CENTERLINE OF STREAM AS FIELD SURVEYED BY GEOD
- OVERHEAD UTILITY LINES
- TRAIL
- WETLAND BOUNDARY (TRIDENT)
- O'CONNOR INVESTIGATION AREA
- LIMIT OF O'CONNOR SURVEY AREA
- TEST PIT LOCATION
- TEST TRENCH LOCATION
- SURFACE SOIL SAMPLE LOCATION
- OVERBURDEN WELL LOCATION
- FILL SAMPLE LOCATION
- BASE SAMPLE LOCATION
- REVISED PAINT SLUDGE LOCATION
- HISTORIC PAINT SLUDGE LOCATION

0 60 120 180
SCALE IN FEET

NOTES:

1. WETLAND BOUNDARY ESTABLISHED BY TRIDENT ENVIRONMENTAL CONSULTANTS (2005).
2. SOIL DATA HAS BEEN SUMMARIZED FOR CLARITY. DETAILED TEST PIT DATA INCLUDING SOIL TYPE AND PID READINGS ARE PROVIDED IN BORING LOGS.

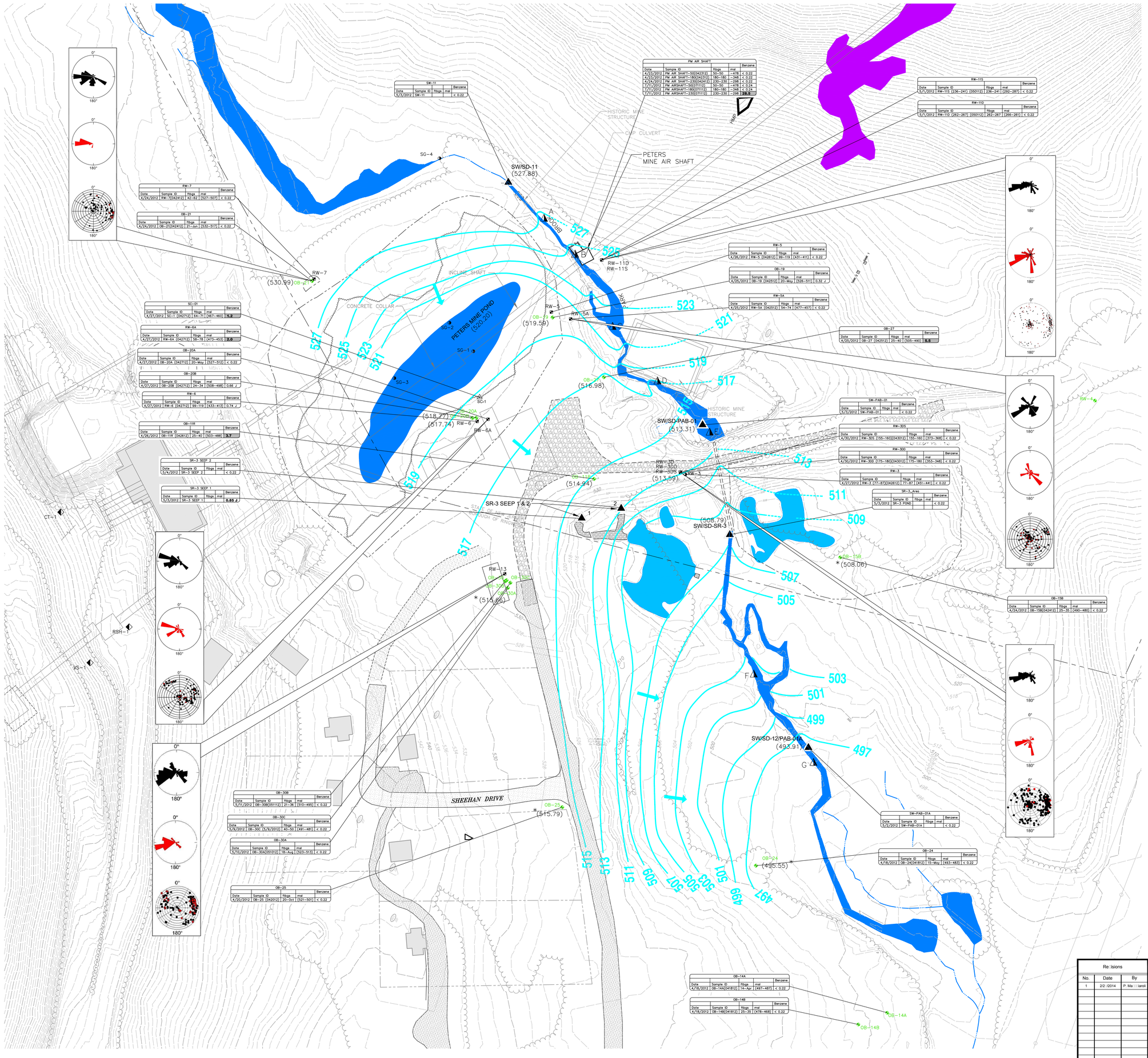
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PLAN VIEW OF FORMER OCDA SUPPLEMENTAL TEST TRENCH AND TEST PIT LOCATIONS

ARCADIS

FIGURE
8B

CITY:(NEWTOWN, PA) SYRACUSE, NY DIV/GROUP: ENV/IMDV DB:(M. WASILEWSKI), P. LISTER PM/TM/TR: J. ROCKLIN LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\N0006040\2013\00035\2014-02\GWFIG-08B OCDA Test Trenches.dwg LAYOUT: 8B SAVED: 2/28/2014 10:55 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 2/28/2014 2:40 PM BY: WASILEWSKI, MATT
IMAGES: PROJECTNAME: ----



SW-11			
Date	Sample ID	ftbgs	msl	Benzene
5/3/2012	SW-11			< 0.22

PM AIR SHAFT				
Date	Sample ID	ftbgs	msl	Benzene
4/23/2012	PM AIR SHAFT-50(042312)	50-50	-478	< 0.22
4/23/2012	PM AIR SHAFT-180(042312)	180-180	-348	< 0.22
4/24/2012	PM AIR SHAFT-230(042412)	230-230	-298	< 0.22
7/11/2012	PM AIRSHAFT-50(071112)	50-50	-478	< 0.24
7/11/2012	PM AIRSHAFT-180(071112)	180-180	-348	< 0.24
7/11/2012	PM AIRSHAFT-230(071112)	230-230	-298	28.5

RW-11S				
Date	Sample ID	ftbgs	msl	Benzene
5/7/2012	RW-11S (236-241) (050112)	236-241	(292-287)	< 0.22

RW-11D				
Date	Sample ID	ftbgs	msl	Benzene
5/7/2012	RW-11D (282-287) (050112)	282-287	(246-241)	< 0.22

RW-7				
Date	Sample ID	ftbgs	msl	Benzene
4/24/2012	RW-7(042412)	42-62	(527-507)	< 0.22

OB-21				
Date	Sample ID	ftbgs	msl	Benzene
4/24/2012	OB-21(042412)	21-Jun	(532-517)	< 0.22

SC-01				
Date	Sample ID	ftbgs	msl	Benzene
4/27/2012	SC-1 (042712)	64-71	(467-460)	1.2

RW-6A				
Date	Sample ID	ftbgs	msl	Benzene
4/27/2012	RW-6A (042712)	58-78	(473-453)	2.8

OB-20A				
Date	Sample ID	ftbgs	msl	Benzene
4/27/2012	OB-20A (042712)	20-May	(527-512)	< 0.22

OB-20B				
Date	Sample ID	ftbgs	msl	Benzene
4/27/2012	OB-20B (042712)	24-34	(508-498)	0.66 J

RW-6				
Date	Sample ID	ftbgs	msl	Benzene
4/27/2012	RW-6 (042712)	99-119	(433-413)	0.74 J

OB-11R				
Date	Sample ID	ftbgs	msl	Benzene
4/26/2012	OB-11R (042612)	25-40	(503-488)	3.7

SR-3 SEEP 2				
Date	Sample ID	ftbgs	msl	Benzene
5/4/2012	SR-3 SEEP 2			< 0.22

SR-3 SEEP 1				
Date	Sample ID	ftbgs	msl	Benzene
5/3/2012	SR-3 SEEP 1			0.85 J

RW-5				
Date	Sample ID	ftbgs	msl	Benzene
4/26/2012	RW-5 (042612)	99-119	(431-411)	< 0.22

OB-19				
Date	Sample ID	ftbgs	msl	Benzene
4/25/2012	OB-19 (042512)	20-May	(528-511)	0.32 J

RW-5A				
Date	Sample ID	ftbgs	msl	Benzene
4/25/2012	RW-5A (042512)	54-74	(477-457)	< 0.22

OB-27				
Date	Sample ID	ftbgs	msl	Benzene
4/25/2012	OB-27 (042512)	25-40	(505-490)	5.5

SW-PAB-01				
Date	Sample ID	ftbgs	msl	Benzene
5/3/2012	SW-PAB-01			< 0.22

RW-3DS				
Date	Sample ID	ftbgs	msl	Benzene
4/30/2012	RW-3DS (155-160)(043012)	155-160	(373-368)	< 0.22

RW-3DD				
Date	Sample ID	ftbgs	msl	Benzene
4/30/2012	RW-3DD (175-180)(043012)	175-180	(353-348)	< 0.22

RW-3				
Date	Sample ID	ftbgs	msl	Benzene
4/27/2012	RW-3 (77-87)(042612)	77-87	(451-441)	< 0.22

SR-3_Area				
Date	Sample ID	ftbgs	msl	Benzene
5/3/2012	SR-3 POND			< 0.22

OB-15B				
Date	Sample ID	ftbgs	msl	Benzene
4/24/2012	OB-15B(042412)	25-35	(490-480)	< 0.22

OB-30B				
Date	Sample ID	ftbgs	msl	Benzene
5/11/2012	OB-30B(051112)	21-38	(510-495)	< 0.22

OB-30C				
Date	Sample ID	ftbgs	msl	Benzene
5/9/2012	OB-30C (5/9/2012)	40-50	(491-481)	< 0.22

OB-30A				
Date	Sample ID	ftbgs	msl	Benzene
5/10/2012	OB-30A(051012)	18-Aug	(523-513)	< 0.22

OB-25				
Date	Sample ID	ftbgs	msl	Benzene
4/20/2012	OB-25 (042012)	20-Oct	(521-501)	< 0.22

SW-PAB-01A				
Date	Sample ID	ftbgs	msl	Benzene
5/2/2012	SW-PAB-01A			< 0.22

OB-24				
Date	Sample ID	ftbgs	msl	Benzene
4/18/2012	OB-24(041812)	15-May	(493-483)	< 0.22

OB-14A				
Date	Sample ID	ftbgs	msl	Benzene
4/18/2012	OB-14A(041812)	14-Apr	(497-487)	< 0.22

OB-14B				
Date	Sample ID	ftbgs	msl	Benzene
4/18/2012	OB-14B(041812)	25-35	(478-468)	< 0.22

LEGEND:

- 530 — EXISTING CONTOUR
- ESTIMATED EXTENT OF HISTORICAL FILL
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- TREE LINE
- LEVEL 9 (ELEVATION -170 msl)
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-19 — OVERBURDEN MONITORING WELL
- SG-1 — STAFF GAUGE
- RW-5 — BEDROCK MONITORING WELL
- CT-1 — TUNNEL OPENING
- VS-1, RSH-1 — MINE SHAFTS
- SC-1 — DIRECTIONAL MONITORING WELL
- 601 — BLOCK
- 12 — LOT
- 537 — GROUNDWATER ELEVATION CONTOUR - OVERBURDEN (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION OF OVERBURDEN (2-FT/ 5-FT CONTOUR INTERVAL)
- (519.12) — GROUNDWATER/SURFACE WATER ELEVATION (FEET MSL)
- WATER BODY
- STREAM
- SW/SD-11 — SURFACE WATER AND SEDIMENT - SAMPLE LOCATION/ STAFF GUAGE
- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT - SAMPLE LOCATION FROM PETERS MINE BROOK/ STAFF GUAGE
- A — PROPOSED PIEZOMETER LOCATION

SAMPLE ID

RW-5				
Date	Sample ID	ftbgs	msl	Benzene
4/26/2012	RW-5 (042612)	99-119	(431-411)	< 0.22

SAMPLE DATE
CONSTITUENT

NOTES:

1. WETLAND BOUNDARY ESTABLISHED BY TRIDENT ENVIRONMENTAL CONSULTANTS (2005).
2. EXTENT OF HISTORIC FILL ESTIMATED FROM 1961 AND 1974 COMPARISON FIGURE.
3. FRACTURE ORIENTATION OF PETERS MINE PIT AREA IS BASED ON BERGEN COUNTY, NEW JERSEY, MAGNETIC NORTH WHICH REPRESENTS A 13 DEGREE WESTERN DECLINATION OF TRUE NORTH.
4. THE ROSE DIAGRAM PLOTS INDICATE PREDOMINANT DOWN-DIP COMPASS AZIMUTHS OF PLANAR FEATURES (FRACTURES), WHICH ARE PERPENDICULAR TO THE STRIKE DIRECTION OF THE PLANE.
5. THE RED ROSE DIAGRAM REPRESENTS INFERRED OPEN FEATURES, AND THE BLACK ROSE DIAGRAM REPRESENTS INFERRED LESS-OPEN FEATURES. DOWN-HOLE OPTICAL TELEVIEWER DATA WAS USED TO PLOT ROSE DIAGRAMS, TO INDICATE THE PREDOMINANT DOWN-DIP AZIMUTHS OF PLANAR FEATURES OBSERVED IN EACH WELL. THESE ROSE DIAGRAMS ARE PRESENTED WITH MAGNETIC NORTH ORIENTED STRAIGHT UP ON THE PRINTED PAGE.
6. POLES (DOTS) PLOTTED CLOSE TO THE OUTER EDGE OF THE CIRCLE REPRESENT PLANES DIPPING MORE STEEPLY THAN POLES PLOTTING TOWARD THE CENTER OF THE CIRCLE. A 45-DEGREE DIP WOULD PLOT HALF WAY BETWEEN THE CENTER AND EDGE OF THE CIRCLE.
7. THE STEREOPLOT AS POLES TO FRACTURE PLANES SUMMARIZES THE OPEN AND LESS-OPEN FEATURE ORIENTATIONS INFERRED FROM EACH TELEVIEWER LOG. EACH STEREOPLOT WAS PREPARED USING AN EQUAL-ANGLE (SCHMIDT) PROJECTION OF THE SOUTHERN HEMISPHERE.
8. SW/SD-3 NOT USED FOR CONTOURING * APRIL 2012 DATA.

0 40 80
SCALE IN FEET

Revisions		
No.	Date	By
1	2/2/2014	P. Ma[illegible]aroli

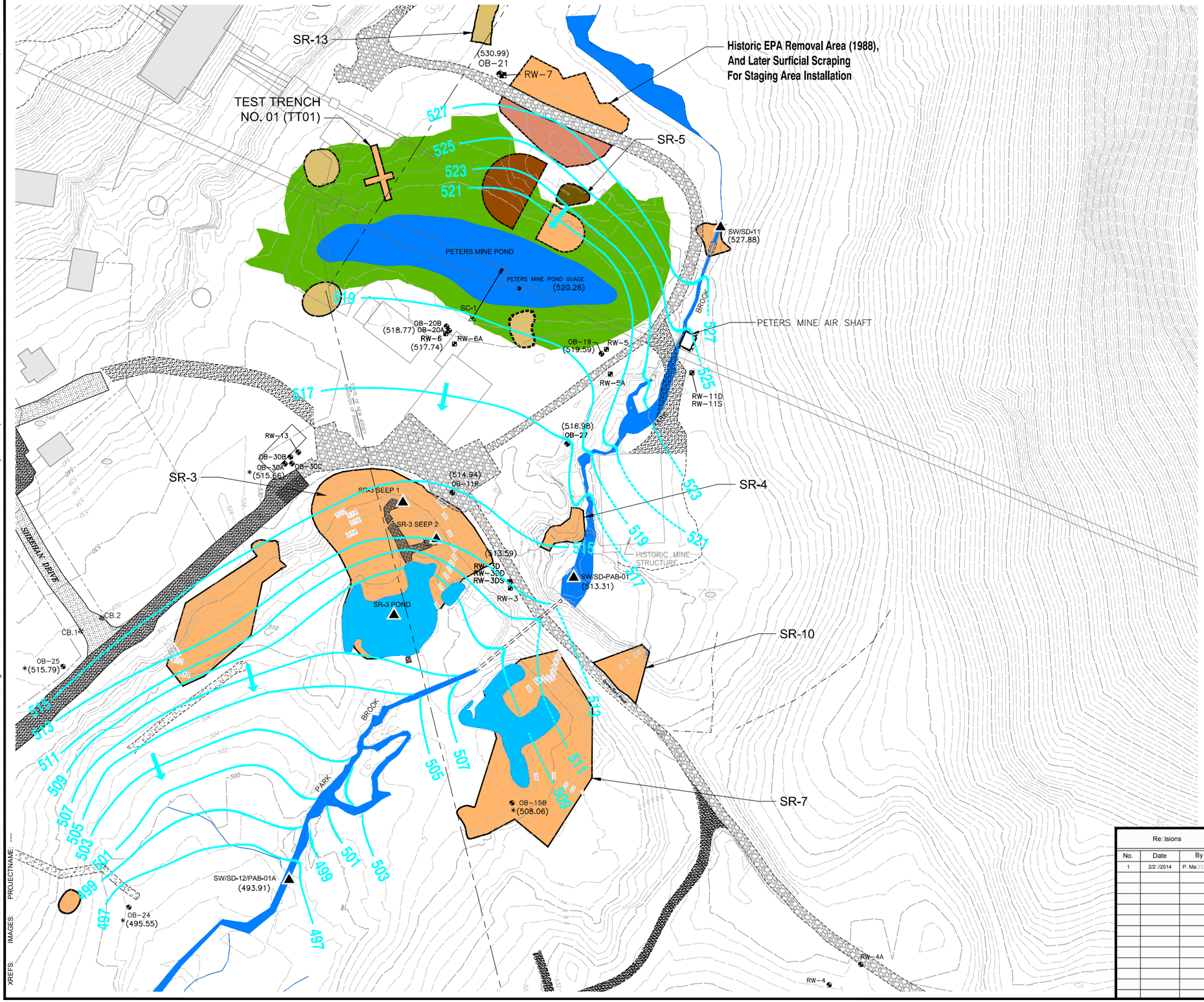
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

FRACTURE ORIENTATION MAP

ARCADIS

FIGURE
9

CITY:MAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Farlawn\ACT\N0006042013\00035\2014\02\WFIG 0 - Fra t re Orientation Map - PMP.dwg LAYOUT: SAVED: 2/2/2014 5:20 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 2/2/2014 5:22 PM BY: GONZALEZ, JAMES
XREFS: IMAGES: PROJECTNAME: ----



LEGEND:

- EXISTING CONTOUR
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- TREE LINE
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-19 OVERBURDEN MONITORING WELL
- STAFF GAUGE
- RW-5 BEDROCK MONITORING WELL
- VS-1 RSH-1 MINE SHAFTS
- SC-1 DIRECTIONAL MONITORING WELL
- 601 BLOCK
- 12 LOT
- 505 GROUNDWATER ELEVATION CONTOUR – OVERBURDEN (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION OF OVERBURDEN (2-FT/ 5-FT CONTOUR INTERVAL)
- GROUNDWATER/SURFACE WATER ELEVATION (FEET MSL) (DATA FROM NOVEMBER 2013)
- SW/SD-11 SURFACE WATER AND SEDIMENT – SAMPLE LOCATION/ STAFF GUAGE
- SW/SD-PMB-01 SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK/ STAFF GUAGE
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE POND (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

NOTE:

1. * APRIL 2012 DATA.

0 60' 120'
GRAPHIC SCALE

Revisions		
No.	Date	By
1	2/2 /2014	P. Ma[illegible]aroli

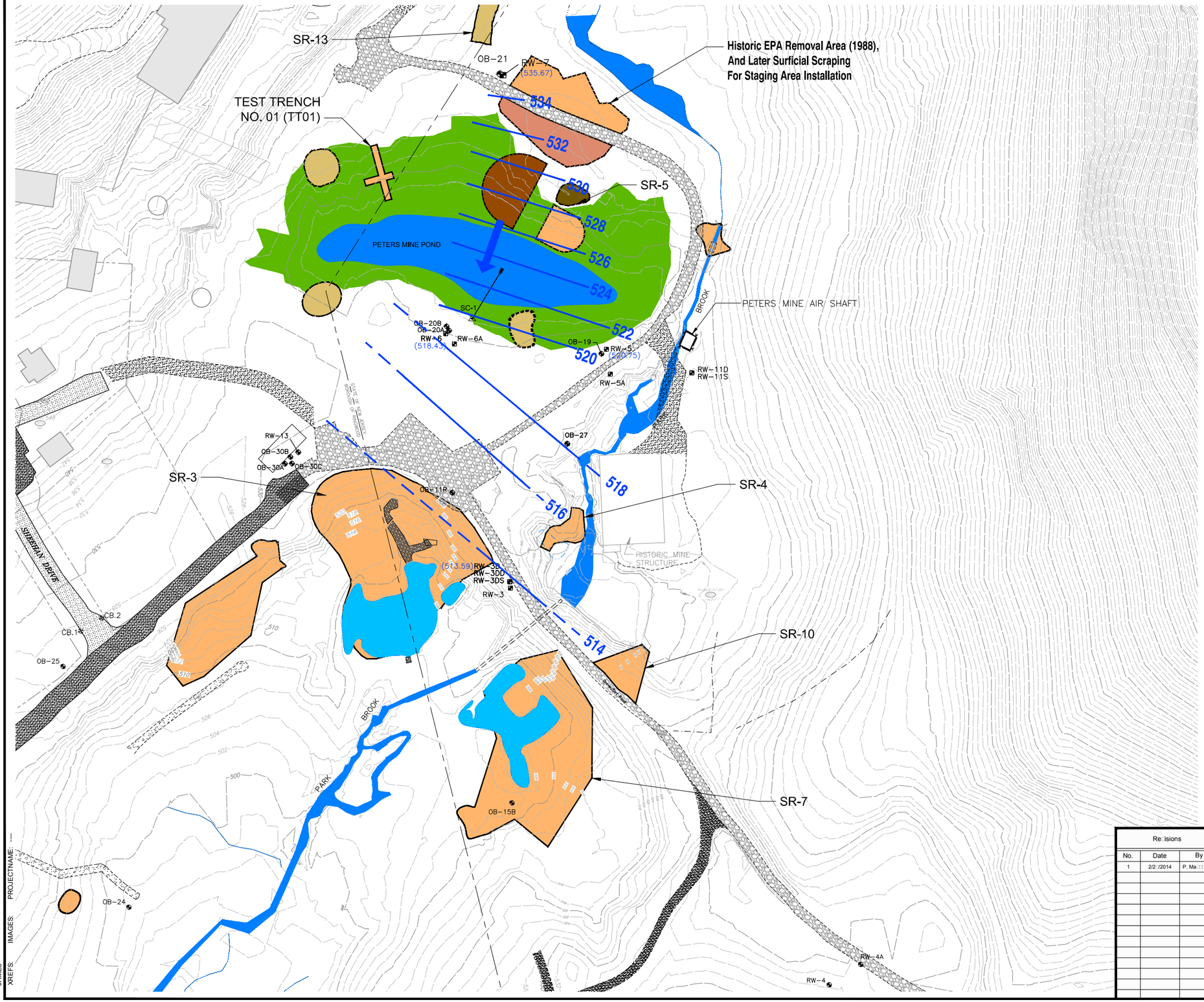
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

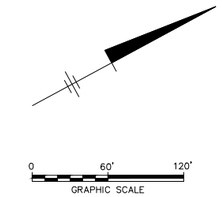
OVERBURDEN WELL LOCATIONS AND GROUNDWATER CONTOURS IN THE PETERS MINE PIT JULY 2012

ARCADIS

FIGURE
10A

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GON ALE LD:J.SEIER PIC:M.MOHIUDDIN PM:E. IMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACT\NJ0060420\2013\00035\2014-02\GWFIG 10A -OB and SW GW 2012-0..dwg LAYOUT: 10A SAVED: 2/2 /2014 11:42 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 2/2 /2014 11:43 AM BY: GON ALE , JAMES
XREFS: IMAGES: PROJECTNAME: ----





LEGEND:

- EXISTING CONTOUR
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-27 OVERBURDEN MONITORING WELL
- RW-5 BEDROCK MONITORING WELL
- SC-1 DIRECTIONAL MONITORING WELL
- 601 BLOCK
- 12 LOT
- MSL MEAN SEA LEVEL
- FT FEET
- 533 GROUNDWATER ELEVATION CONTOUR – SHALLOW BEDROCK
- GROUNDWATER FLOW DIRECTION OF SHALLOW BEDROCK INTERVAL 100' (2–FT CONTOUR INTERVAL)
- (519.12) GROUNDWATER ELEVATION (FEET MSL)
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE POND (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

NOTES:

1. BEDROCK CONTOURS BASED ON INTERVAL 75 TO 125 FEET BELOW GROUND SURFACE (405–440 FT MSL).
2. RW–5A AND RW–6A NOT USED TO CONTOUR BEDROCK.

Revisions		
No.	Date	By
1	2/2 /2014	P. Ma[illegible]aroli

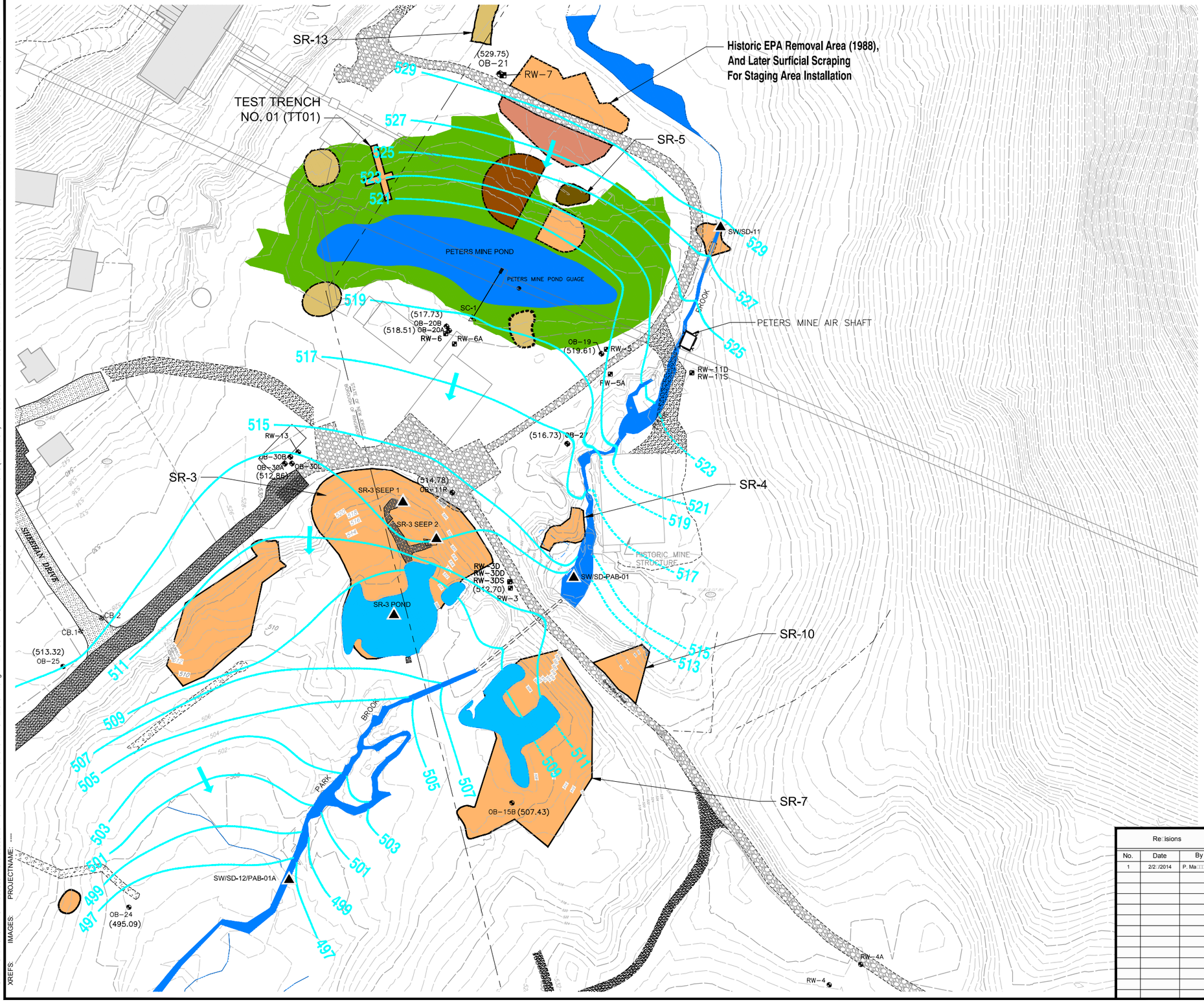
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND SHALLOW BEDROCK GROUNDWATER CONTOURS IN THE PETERS MINE PIT APRIL 2012

ARCADIS

FIGURE
10B

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GON ALE LD:J.SEIER PIC:M.MOHIUDDIN PM:E. IMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACT\NJ0006042013\00035\2014-02\GW\FIG 10B 11B -S allow Res Its Apr2012-No 2013.dwg LAYOUT: 10B SAVED: 2/2 /2014 2:25 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 2/2 /2014 2:26 PM BY: GON ALE
JAMES
XREFS: IMAGES: PROJECTNAME: ----



LEGEND:

- EXISTING CONTOUR
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- TREE LINE
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-19 — OVERBURDEN MONITORING WELL
- STAFF GAUGE
- RW-5 — BEDROCK MONITORING WELL
- VS-1 / RSH-1 — MINE SHAFTS
- SC-1 — DIRECTIONAL MONITORING WELL
- 601 — BLOCK
- 12 — LOT
- 505 — GROUNDWATER ELEVATION CONTOUR – OVERBURDEN (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION OF OVERBURDEN (2-FT/ 5-FT CONTOUR INTERVAL)
- (512.70) — GROUNDWATER/SURFACE WATER ELEVATION (FEET MSL) (DATA FROM NOVEMBER 2013)
- SW/SD-11 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION/ STAFF GUAGE
- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK/ STAFF GUAGE
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE POND (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

NOTE:

1. SURFACE WATER ELEVATIONS WERE NOT AVAILABLE DURING THE NOVEMBER 2013 EVENT.

0 60' 120'
GRAPHIC SCALE

Revisions		
No.	Date	By
1	2/2 /2014	P. Ma[illegible]iaroli

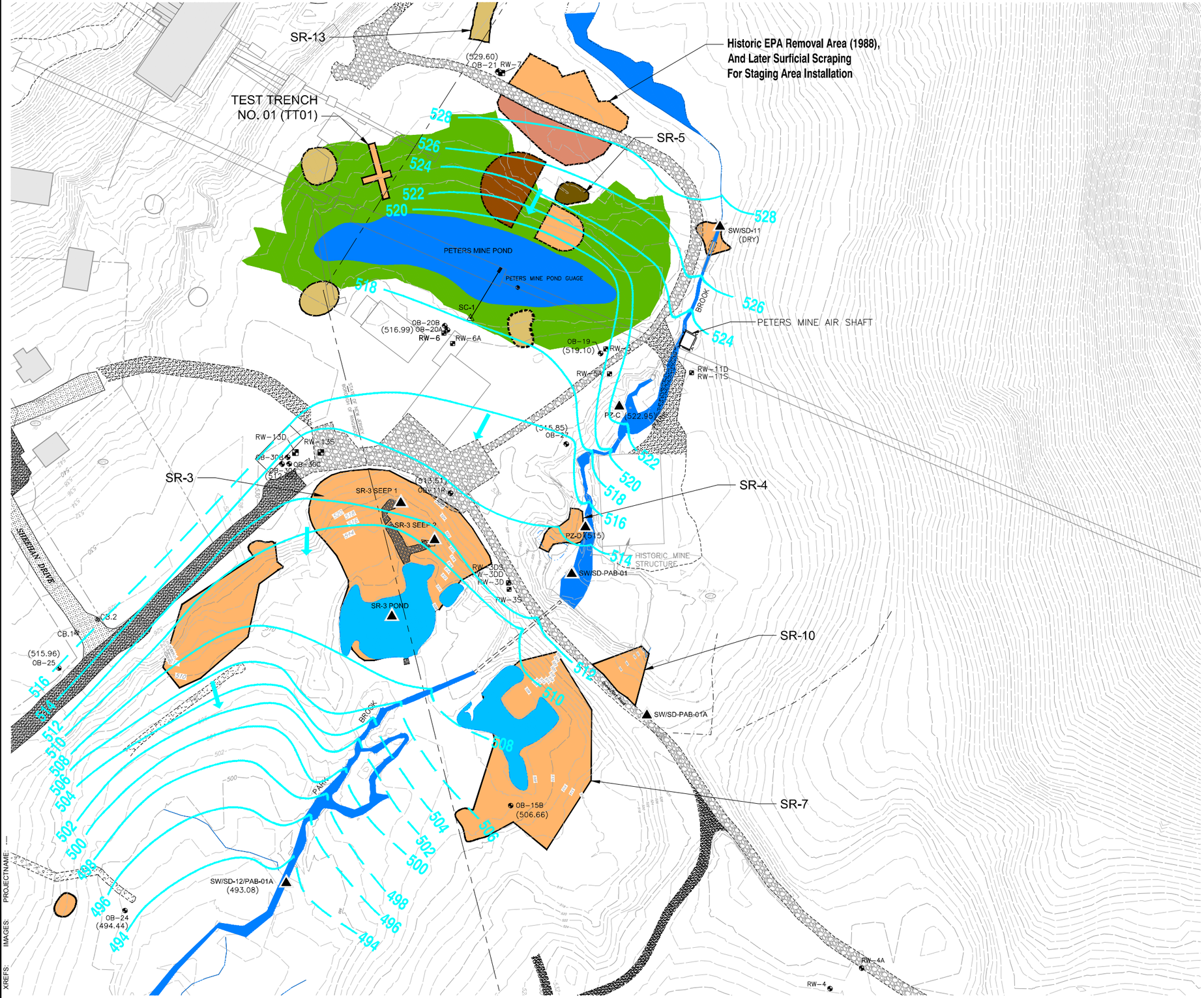
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

OVERBURDEN WELL LOCATIONS AND GROUNDWATER CONTOURS IN THE PETERS MINE PIT NOVEMBER 2013

ARCADIS

FIGURE
11A

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GON ALE: LD:J.SEIER PIC:M.MOHIUDDIN PM:E. IMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACT\NJ0060842\2013\00035\2014-02\GW\FIG 11A-OB and RW GW 2013-11.dwg LAYOUT: 11A SAVED: 2/2 /2014 2:31 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 2/2 /2014 2:32 PM BY: GON ALE , JAMES
XREFS: IMAGES: PROJECTNAME: ----



LEGEND:

- EXISTING CONTOUR
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- TREE LINE
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-19 — OVERBURDEN MONITORING WELL
- STAFF GAUGE
- RW-5 — BEDROCK MONITORING WELL
- VS-1 RSH-1 — MINE SHAFTS
- SC-1 — DIRECTIONAL MONITORING WELL
- 601 — BLOCK
- 12 — LOT
- 505 — GROUNDWATER ELEVATION CONTOUR – OVERBURDEN (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION OF OVERBURDEN
- (512.70) — GROUNDWATER/SURFACE WATER ELEVATION (FEET MSL) (DATA FROM SEPTEMBER 2014)
- SW/SD-11 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION/ STAFF GUAGE
- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK/ STAFF GUAGE
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE POND (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

NOTES:

1. RW-3S REPRESENTS THE 77-87 FOOT INTERVAL AND RW-3D IS A MULTIPORT WELL.
2. RW-13S REPRESENTS THE 71-91 FOOT INTERVAL AND RW-13D IS A MULTIPORT WELL.

0 60' 120'
GRAPHIC SCALE

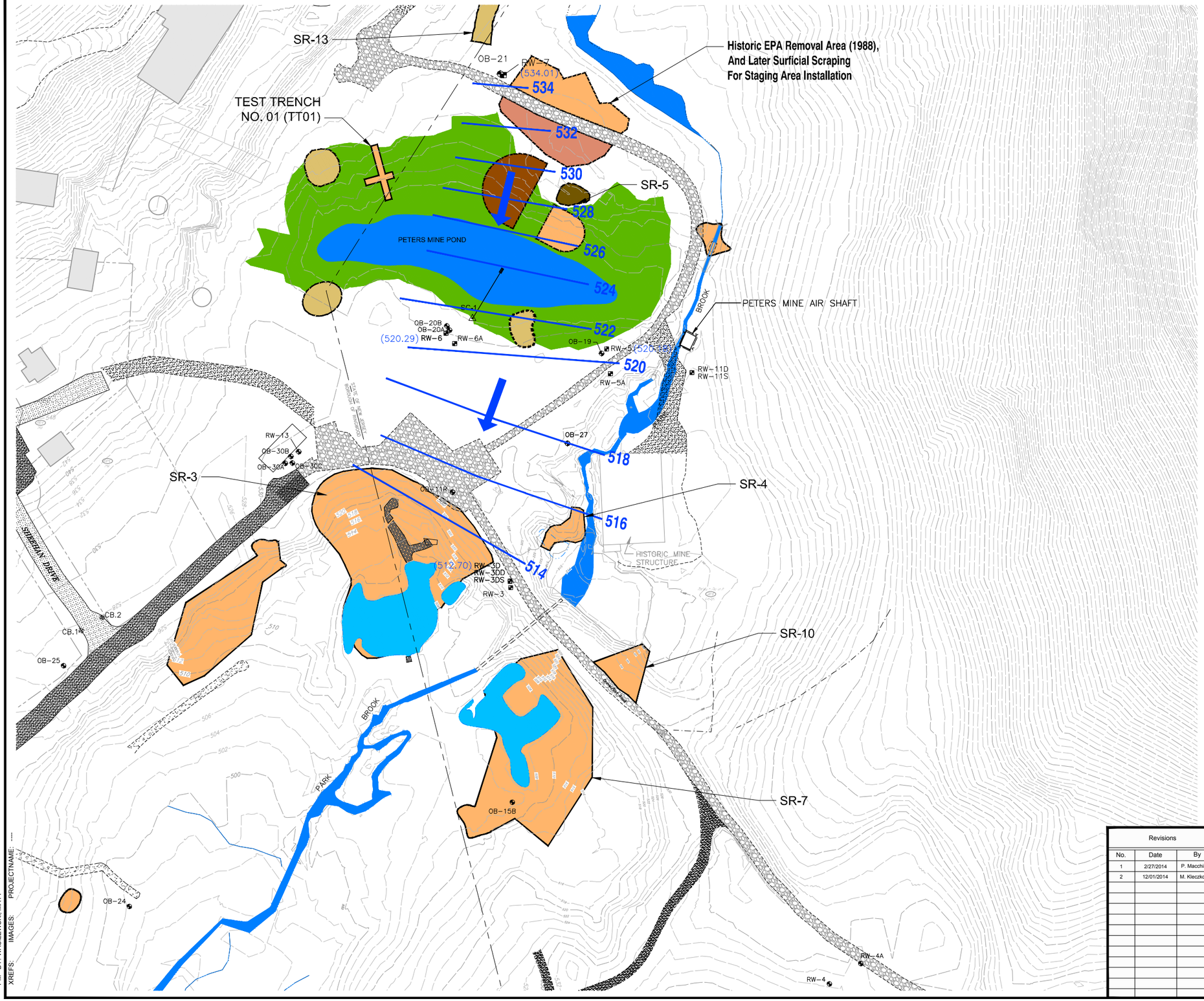
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

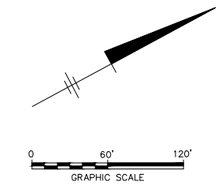
OVERBURDEN WELL LOCATIONS AND GROUNDWATER CONTOURS IN THE PETERS MINE PIT - SEPTEMBER 2014

ARCADIS

FIGURE
11B

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
\\ARCADIS-US\officedata\Fairlawn-NJ\ENVCAD\Fairlawn\ACT\NJ0006042014000013\DWG\GWFIG 11B -OB and RW GW_9-2014.dwg LAYOUT: 11B SAVED: 12/1/2014 5:59 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 12/1/2014 6:01 PM
BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----





LEGEND:

- EXISTING CONTOUR
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-27 OVERBURDEN MONITORING WELL
- RW-5 BEDROCK MONITORING WELL
- SC-1 DIRECTIONAL MONITORING WELL
- 601 BLOCK
- 12 LOT
- MSL MEAN SEA LEVEL
- FT FEET
- 520 GROUNDWATER ELEVATION CONTOUR – SHALLOW BEDROCK
- GROUNDWATER FLOW DIRECTION OF SHALLOW BEDROCK INTERVAL 100' (2–FT CONTOUR INTERVAL)
- (520.18) GROUNDWATER ELEVATION (FEET MSL)
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE POND (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

NOTES:

1. BEDROCK CONTOURS BASED ON INTERVAL 75 TO 125 FEET BELOW GROUND SURFACE (405–440 FT MSL).
2. RW–5A AND RW–6A NOT USED TO CONTOUR BEDROCK.

Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	12/01/2014	M. Kleczkowski

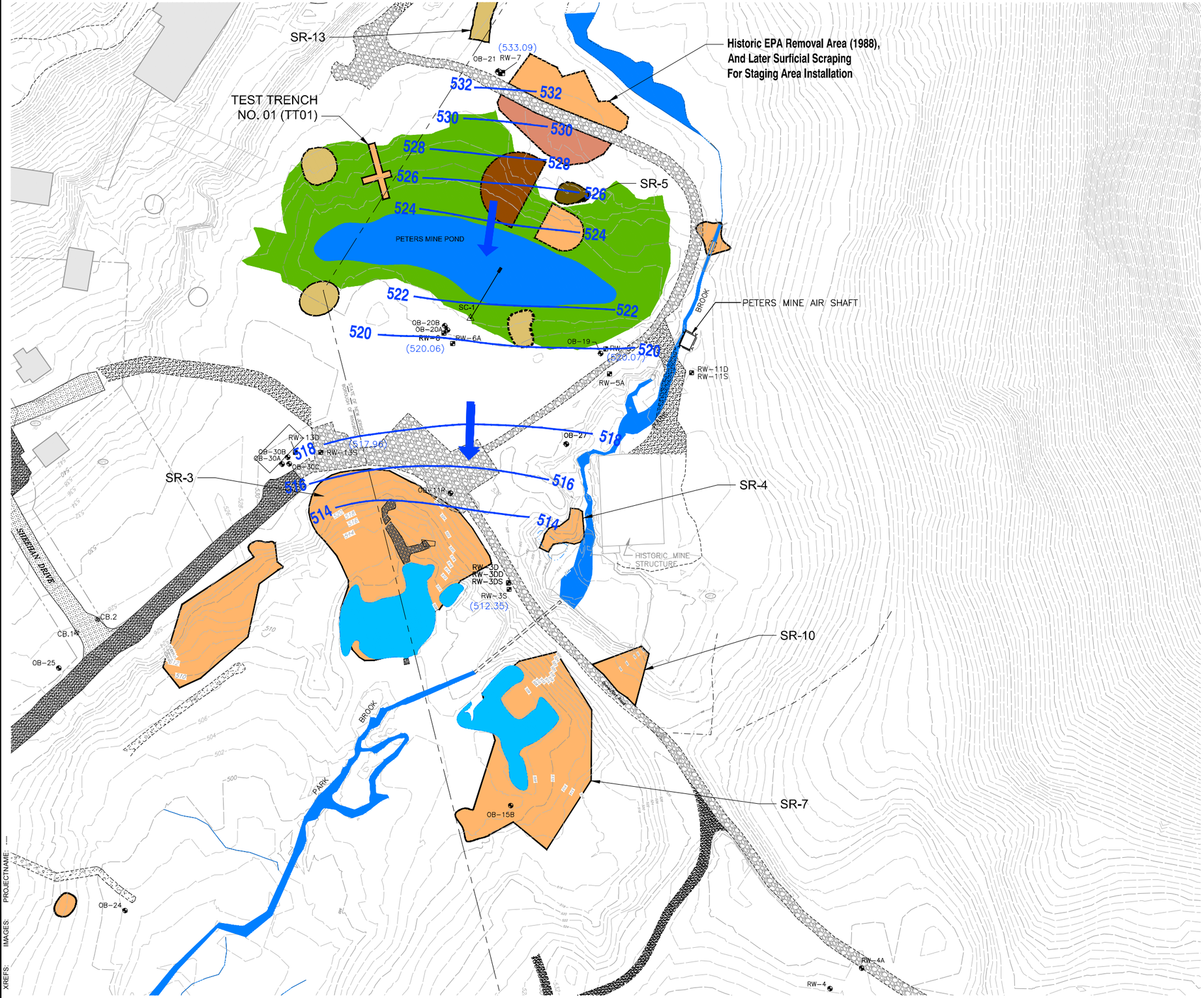
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND SHALLOW BEDROCK GROUNDWATER CONTOURS IN THE PETERS MINE PIT NOVEMBER 2013

ARCADIS

FIGURE
11C

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACTRETURN-TO\Fairlawn-NJ\NJ00060\42014\00011\GWR\R\FIG 10B_11C-Shallow Results_Apr2012-Nov2013.dwg LAYOUT: 11C SAVED: 12/1/2014 4:19 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 12/1/2014 4:26
PM BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----



0 60' 120'
GRAPHIC SCALE

LEGEND:

- EXISTING CONTOUR
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- EXISTING DIRT TRAIL/ROAD
- STABILIZED ACCESS ROAD
- OB-27 OVERBURDEN MONITORING WELL
- RW-5 BEDROCK MONITORING WELL
- SC-1 DIRECTIONAL MONITORING WELL
- 601 BLOCK
- 12 LOT
- MSL MEAN SEA LEVEL
- FT FEET
- 520 GROUNDWATER ELEVATION CONTOUR – SHALLOW BEDROCK
- GROUNDWATER FLOW DIRECTION OF SHALLOW BEDROCK INTERVAL 100' (2-FT CONTOUR INTERVAL)
- (520.18) GROUNDWATER ELEVATION (FEET MSL) (DATA FROM SEPTEMBER 2014)
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
- APPROXIMATE LIMITS OF SURFICIAL SOIL SCRAPING
- HISTORICAL FILL AREA SURROUNDING PETERS MINE POND (AREA 1)
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

NOTES:

1. BEDROCK CONTOURS BASED ON INTERVAL 75 TO 125 FEET BELOW GROUND SURFACE (405–440 FT MSL).
2. RW–5A AND RW–6A NOT USED TO CONTOUR BEDROCK.
3. RW–3S REPRESENTS THE 77–87 FOOT INTERVAL AND RW–3D IS A MULTIPORT WELL.
4. RW–13S REPRESENTS THE 71–91 FOOT INTERVAL AND RW–13D IS A MULTIPORT WELL.

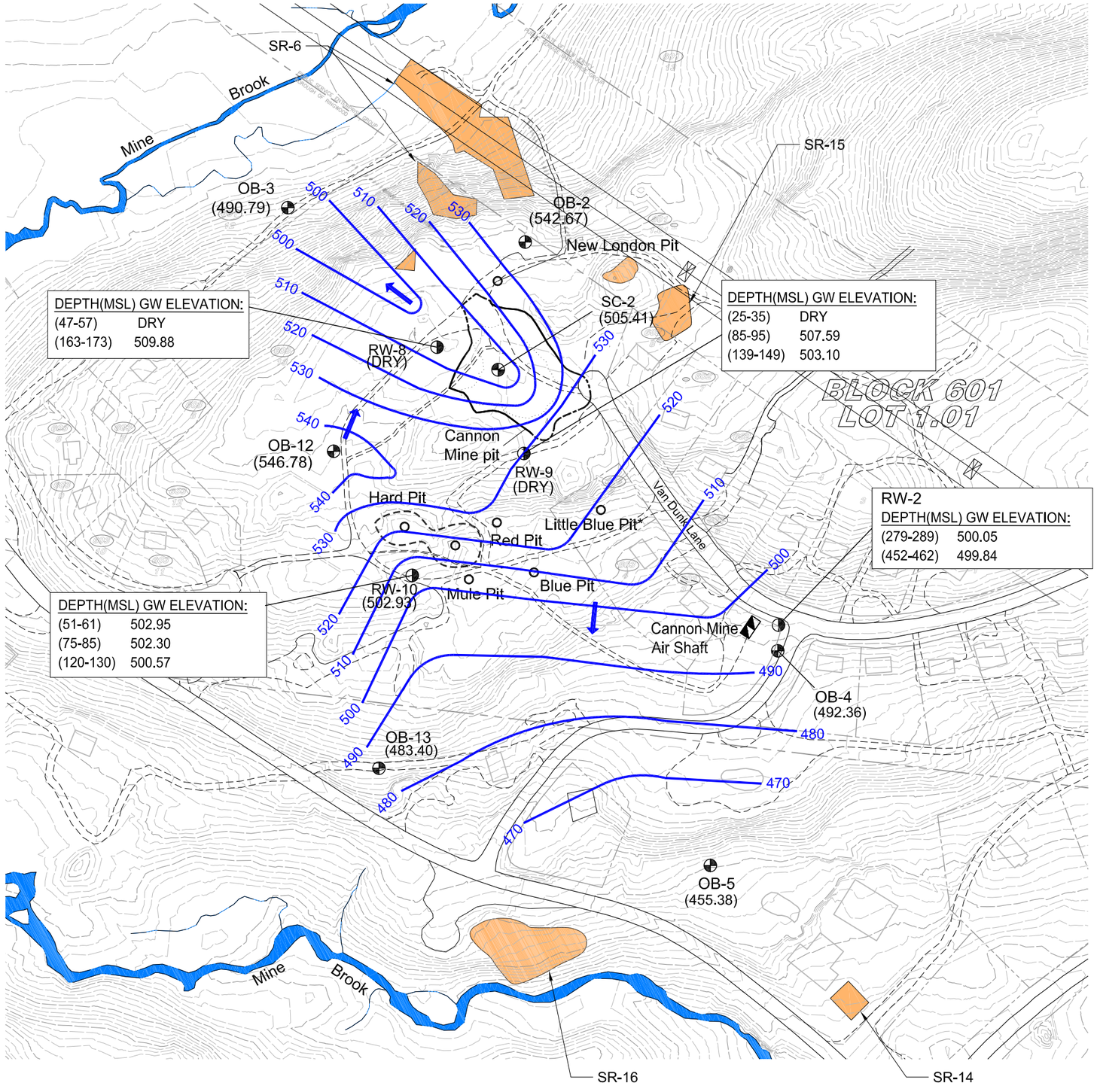
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND SHALLOW BEDROCK GROUNDWATER CONTOURS IN THE PETERS MINE PIT - SEPTEMBER 2014

ARCADIS

FIGURE
11D

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
\\arcadis-us.com\officedata\Fairlawn-NJ\ENV\CAD\Fairlawn\ACT - 2015\NJ00060420140001\3\DWG\GWFIG 11D-Shallow Results_9-2014.dwg LAYOUT: 11D SAVED: 1/7/2015 1:43 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/7/2015 1:44
PM BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----



0 100 200 300
SCALE IN FEET

	Well ID	bottom screen depth (feet)	top screen depth (feet)	bottom screen depth (MSL)	top screen depth (MSL)	Monitoring Method
Monitors Cannon Mine Pit	SC-2	67	47	497.13	517.13	Low Flow
Shallow Bedrock	OB-2	42	8	520.3	554.3	Low Flow
	OB-3	24	9	472.53	487.53	Low Flow
	OB-4	61	28	449.8	482.8	Low Flow
	OB-5	63	18	395.83	440.83	Low Flow
	OB-12	40	9	518.36	549.36	Low Flow
	OB-13	60	8	440.35	492.35	Low Flow
	RW-8A(47-57)	57	47	512.55	522.55	ZIST Pump
	RW-9A(25-35)	35	25	526.82	536.82	ZIST Pump
	RW-9A(85-95)	95	85	466.73	476.73	ZIST Pump
	RW-10A(51-61)	61	51	478.43	488.43	ZIST Pump
	RW-10A(75-85)	85	75	454.45	464.45	ZIST Pump

LEGEND

- RESIDENCE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- GROUND SURFACE ELEVATION CONTOUR
- RW-10 (502.93) — EXISTING BEDROCK MONITORING WELL WITH GROUNDWATER ELEVATION
- 470 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL (SHALLOW BEDROCK)
- GROUNDWATER FLOW DIRECTION OF SHALLOW BEDROCK BEDROCK INTERVAL APRIL 2012 (FT. MSL.) (10–FT CONTOUR INTERVAL)
- FT. MSL. – FEET ABOVE MEAN SEA LEVEL
- APPROXIMATE LIMITS OF PAINT SLUDGE REMOVAL AREAS
- WATER BODY
- STREAM

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

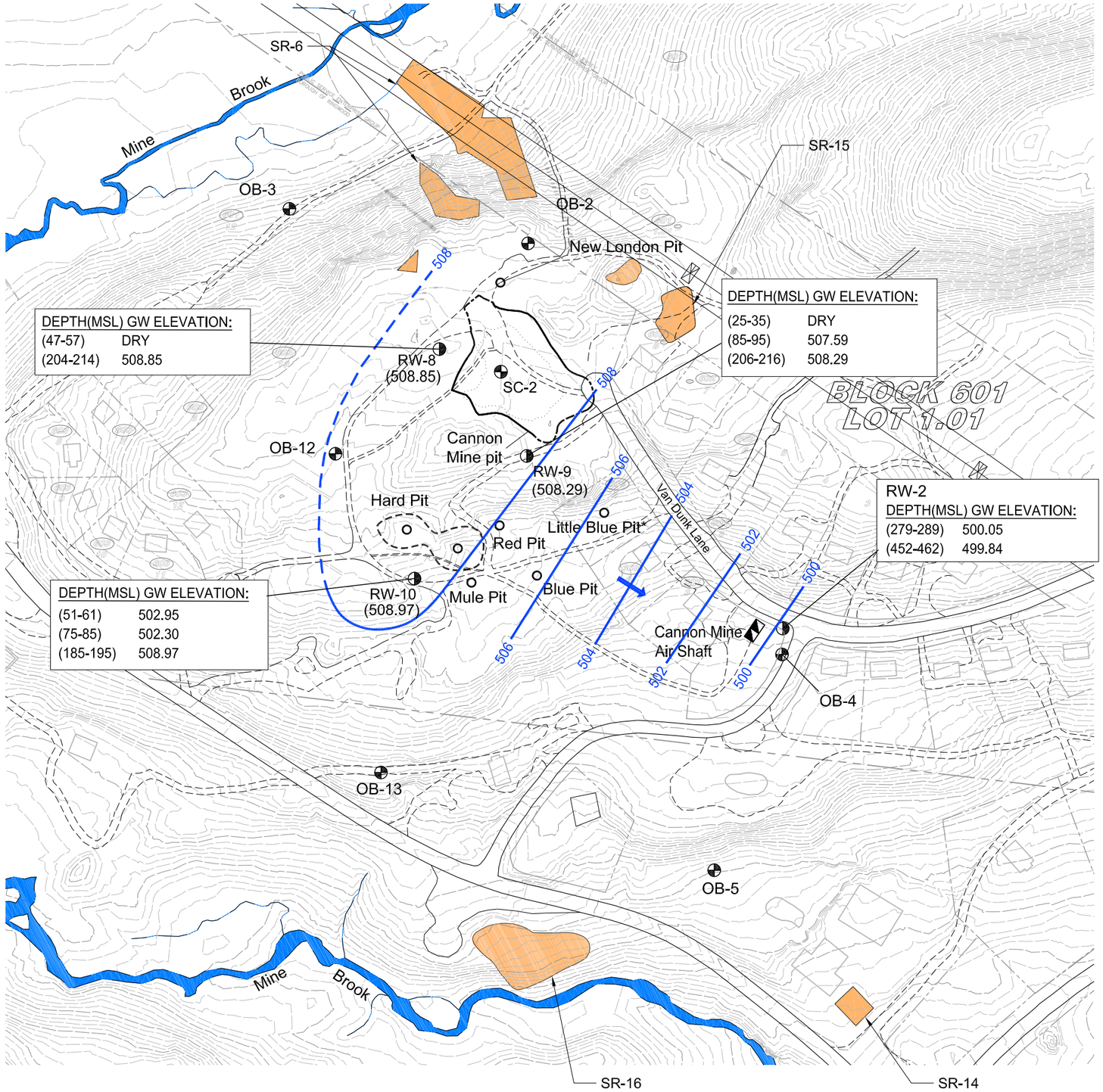
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

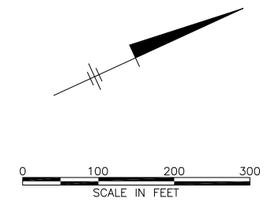
WELL LOCATIONS AND SHALLOW BEDROCK GROUNDWATER ELEVATION CONTOURS IN THE CMP - APRIL 2012

ARCADIS

FIGURE
12A

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACT\NJ0006042013\0003S\2014-02\GW\FIG 12A -WELLS AND GW ELEVATION CONTOURS - 04-2012 - SHAL-BEDROCK.dwg LAYOUT: 12A SAVED: 2/26/2014 11:18 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED:
2/27/2014 2:34 PM BY: GONZALEZ, JAMES
XREFS: IMAGES: PROJECTNAME: ----





	Well ID	bottom screen depth (feet)	top screen depth (feet)	bottom screen depth (MSL)	top screen depth (MSL)	Monitoring Method
Monitors Cannon Mine Pit	SC-2	67	47	497.13	517.13	Low Flow
Shallow Bedrock	OB-2	42	8	520.3	554.3	Low Flow
	OB-3	24	9	472.53	487.53	Low Flow
	OB-4	61	28	449.8	482.8	Low Flow
	OB-5	63	18	395.83	440.83	Low Flow
	OB-12	40	9	518.36	549.36	Low Flow
	OB-13	60	8	440.35	492.35	Low Flow
	RW-8A(47-57)	57	47	512.55	522.55	ZIST Pump
	RW-9A(25-35)	35	25	526.82	536.82	ZIST Pump
	RW-9A(85-95)	95	85	466.73	476.73	ZIST Pump
	RW-10A(51-61)	61	51	478.43	488.43	ZIST Pump
	RW-10A(75-85)	85	75	454.45	464.45	ZIST Pump

LEGEND

- RESIDENCE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- GROUND SURFACE ELEVATION CONTOUR
- RW-10 (508.97) — EXISTING BEDROCK MONITORING WELL WITH GROUNDWATER ELEVATION
- 500 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL (DEEP)
- GROUNDWATER FLOW DIRECTION OF DEEP BEDROCK BEDROCK INTERVAL APRIL 2012 (FT. MSL.) (10–FT CONTOUR INTERVAL)
- FT. MSL. – FEET ABOVE MEAN SEA LEVEL
- APPROXIMATE LIMITS OF PAINT SLUDGE REMOVAL AREAS
- WATER BODY
- STREAM

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

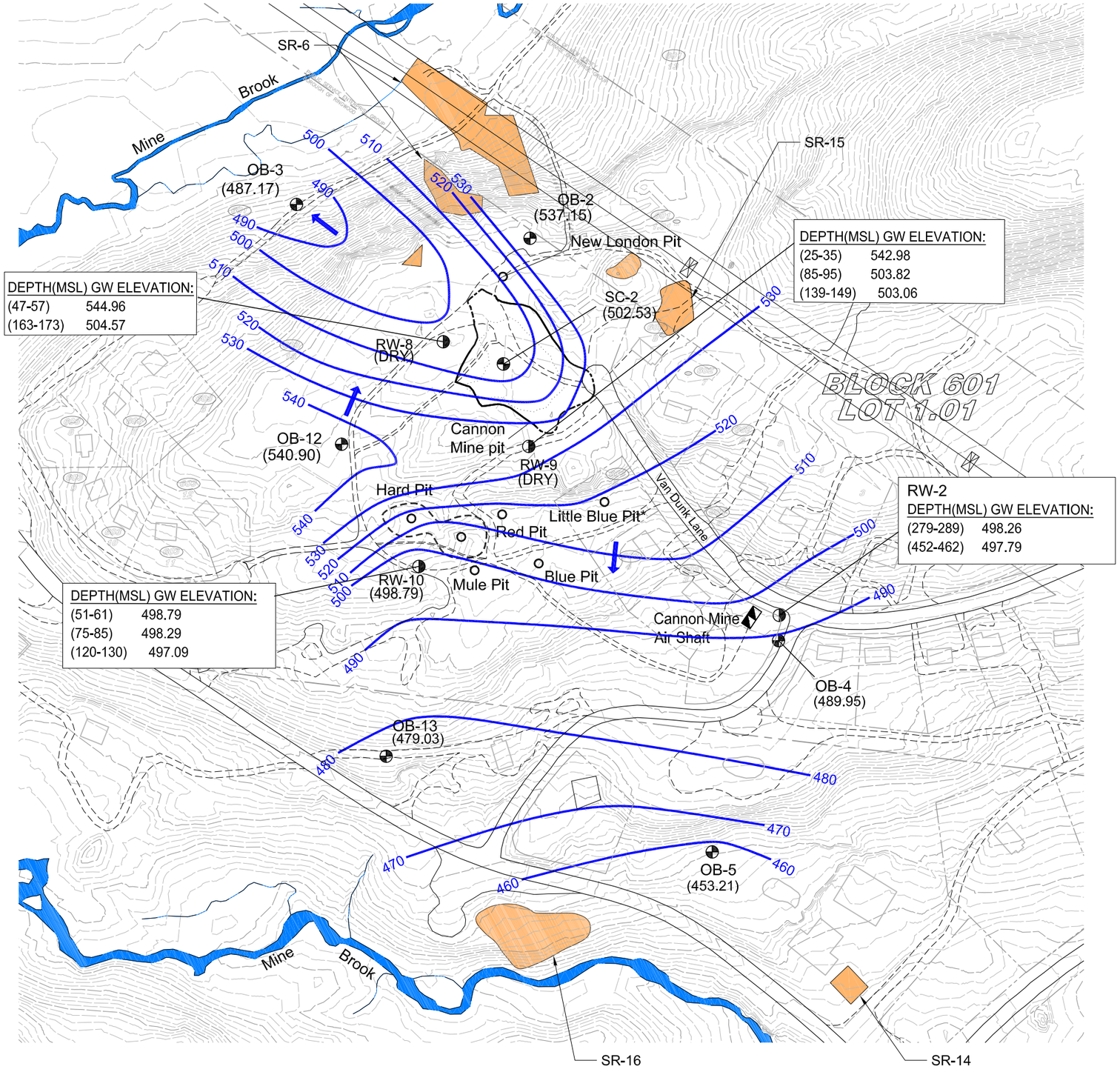
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

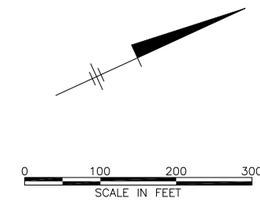
WELL LOCATIONS AND DEEP BEDROCK GROUNDWATER ELEVATION CONTOURS IN THE CMP - APRIL 2012

ARCADIS

FIGURE
12B

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACTN\J0006042013\00035\2014-02\GWFIG 12B -WELLS AND GW ELEVATION CONTOURS - 04-2012 - DEEP-BEDROCK.dwg LAYOUT: 12B SAVED: 2/26/2014 1:12 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED:
2/27/2014 2:36 PM BY: GONZALEZ, JAMES
XREFS: IMAGES: PROJECTNAME: ----





	Well ID	bottom screen depth (feet)	top screen depth (feet)	bottom screen depth (MSL)	top screen depth (MSL)	Monitoring Method
Monitors Cannon Mine Pit	SC-2	67	47	497.13	517.13	Low Flow
Shallow Bedrock	OB-2	42	8	520.3	554.3	Low Flow
	OB-3	24	9	472.53	487.53	Low Flow
	OB-4	61	28	449.8	482.8	Low Flow
	OB-5	63	18	395.83	440.83	Low Flow
	OB-12	40	9	518.36	549.36	Low Flow
	OB-13	60	8	440.35	492.35	Low Flow
	RW-8A(47-57)	57	47	512.55	522.55	ZIST Pump
	RW-9A(25-35)	35	25	526.82	536.82	ZIST Pump
	RW-9A(85-95)	95	85	466.73	476.73	ZIST Pump
	RW-10A(51-61)	61	51	478.43	488.43	ZIST Pump
	RW-10A(75-85)	85	75	454.45	464.45	ZIST Pump

LEGEND

- RESIDENCE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- GROUND SURFACE ELEVATION CONTOUR
- RW-10 (498.79) — EXISTING BEDROCK MONITORING WELL WITH GROUNDWATER ELEVATION
- 500 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL (SHALLOW BEDROCK)
- GROUNDWATER FLOW DIRECTION OF SHALLOW BEDROCK BEDROCK INTERVAL NOVEMBER 2013 (FT. MSL.) (10–FT CONTOUR INTERVAL)
- FT. MSL. – FEET ABOVE MEAN SEA LEVEL
- APPROXIMATE LIMITS OF PAINT SLUDGE REMOVAL AREAS
- WATER BODY
- STREAM

Revisions		
No.	Date	By
1	2/27/2014	P. MacchiaroII

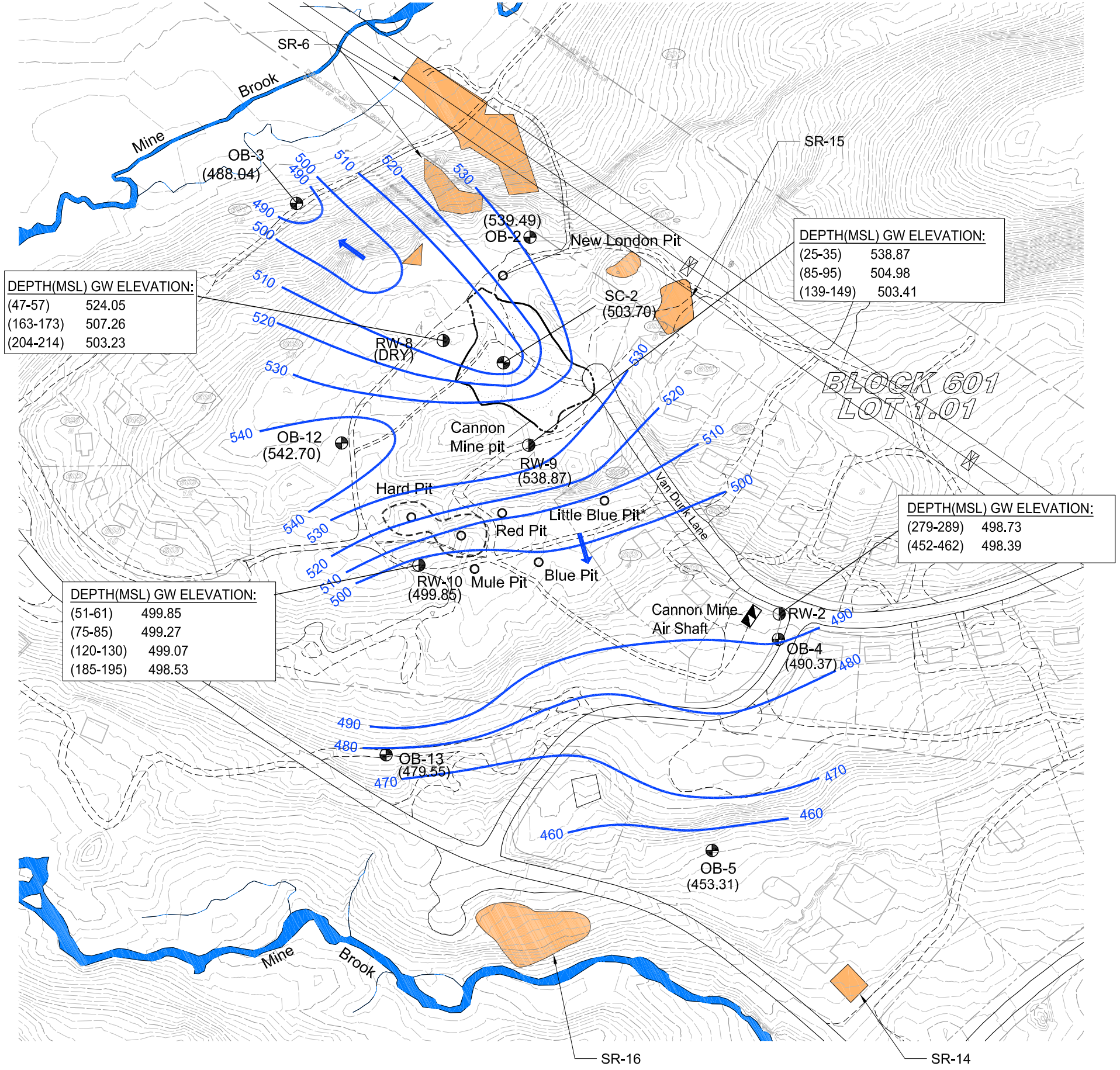
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND SHALLOW BEDROCK GROUNDWATER ELEVATION CONTOURS IN THE CMP - NOVEMBER 2013

ARCADIS

FIGURE
13A

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACT\NJ0006041\2013\00035\2014-02\GW\FIG 13A -WELLS AND GW ELEVATION CONTOURS - 11-2013 - SHAL-BEDROCK.dwg LAYOUT: 13A SAVED: 2/26/2014 11:21 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED:
2/27/2014 2:37 PM BY: GONZALEZ, JAMES
XREFS: IMAGES: PROJECTNAME: ----



0 100 200 300
SCALE IN FEET

	Well ID	bottom screen depth (feet)	top screen depth (feet)	bottom screen depth (MSL)	top screen depth (MSL)	Monitoring Method
Monitors Cannon Mine Pit	SC-2	67	47	497.13	517.13	Low Flow
Shallow Bedrock	OB-2	42	8	520.3	554.3	Low Flow
	OB-3	24	9	472.53	487.53	Low Flow
	OB-4	61	28	449.8	482.8	Low Flow
	OB-5	63	18	395.83	440.83	Low Flow
	OB-12	40	9	518.36	549.36	Low Flow
	OB-13	60	8	440.35	492.35	Low Flow
	RW-8A(47-57)	57	47	512.55	522.55	ZIST Pump
	RW-9A(25-35)	35	25	526.82	536.82	ZIST Pump
	RW-9A(85-95)	95	85	466.73	476.73	ZIST Pump
	RW-10A(51-61)	61	51	478.43	488.43	ZIST Pump
	RW-10A(75-85)	85	75	454.45	464.45	ZIST Pump

LEGEND

- RESIDENCE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- GROUND SURFACE ELEVATION CONTOUR
- RW-10 (498.79) — BEDROCK MONITORING WELL WITH GROUNDWATER ELEVATION
- 490 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL (SHALLOW BEDROCK)
- GROUNDWATER FLOW DIRECTION OF SHALLOW BEDROCK BEDROCK INTERVAL SEPTEMBER 2014 (FT. MSL.) (10–FT CONTOUR INTERVAL)
- FT. MSL. – FEET ABOVE MEAN SEA LEVEL
- APPROXIMATE LIMITS OF PAINT SLUDGE REMOVAL AREAS
- WATER BODY
- STREAM

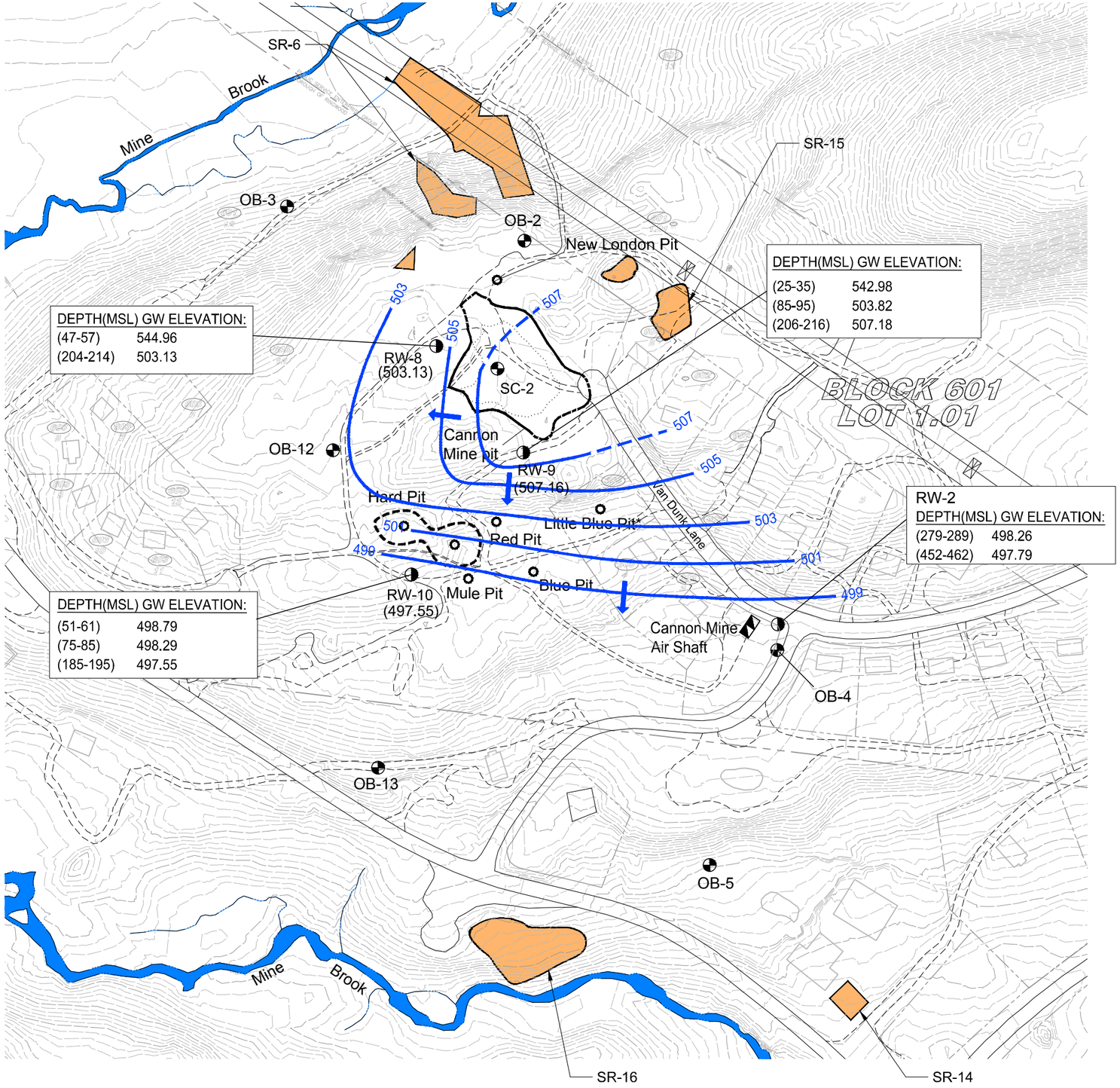
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND SHALLOW BEDROCK GROUNDWATER ELEVATION CONTOURS IN THE CMP - SEPTEMBER 2014

ARCADIS

FIGURE
13B

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
\\arcadis-us.com\office\data\Fairlawn-NJ\ENV\CAD\Fairlawn\ACT - 2015\NJ000604\2014\00013\DWG\GWFIG 13B -WELLS AND GW ELEVATION CONTOURS - 9-2014 - SHAL-BEDROCK.dwg LAYOUT: 13B SAVED: 1/7/2015 1:37 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE:
ARCADIS-MAHWAH.CTB PLOTTED: 1/7/2015 1:38 PM BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----



0 100 200 300
SCALE IN FEET

	Well ID	bottom screen depth (feet)	top screen depth (feet)	bottom screen depth (MSL)	top screen depth (MSL)	Monitoring Method
Monitors Cannon Mine Pit	SC-2	67	47	497.13	517.13	Low Flow
Shallow Bedrock	OB-2	42	8	520.3	554.3	Low Flow
	OB-3	24	9	472.53	487.53	Low Flow
	OB-4	61	28	449.8	482.8	Low Flow
	OB-5	63	18	395.83	440.83	Low Flow
	OB-12	40	9	518.36	549.36	Low Flow
	OB-13	60	8	440.35	492.35	Low Flow
	RW-8A(47-57)	57	47	512.55	522.55	ZIST Pump
	RW-9A(25-35)	35	25	526.82	536.82	ZIST Pump
	RW-9A(85-95)	95	85	466.73	476.73	ZIST Pump
	RW-10A(51-61)	61	51	478.43	488.43	ZIST Pump
	RW-10A(75-85)	85	75	454.45	464.45	ZIST Pump

LEGEND

- RESIDENCE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- GROUND SURFACE ELEVATION CONTOUR
- RW-10 (497.55) — EXISTING BEDROCK MONITORING WELL WITH GROUNDWATER ELEVATION
- 499 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL (DEEP)
- GROUNDWATER FLOW DIRECTION OF DEEP BEDROCK INTERVAL NOVEMBER 2013 (FT. MSL.) (2-FT CONTOUR INTERVAL)
- FT. MSL. — FEET ABOVE MEAN SEA LEVEL
- APPROXIMATE LIMITS OF PAINT SLUDGE REMOVAL AREAS
- WATER BODY
- STREAM

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli
2	12/01/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND DEEP BEDROCK GROUNDWATER ELEVATION CONTOURS IN THE CMP - NOVEMBER 2013

ARCADIS

FIGURE
13C

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00011\GWRI\FIG 13C -WELLS AND GW ELEVATION CONTOURS - 11-2013 - DEEP-BEDROCK.dwg LAYOUT: 13C SAVED: 12/1/2014 4:25 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE:
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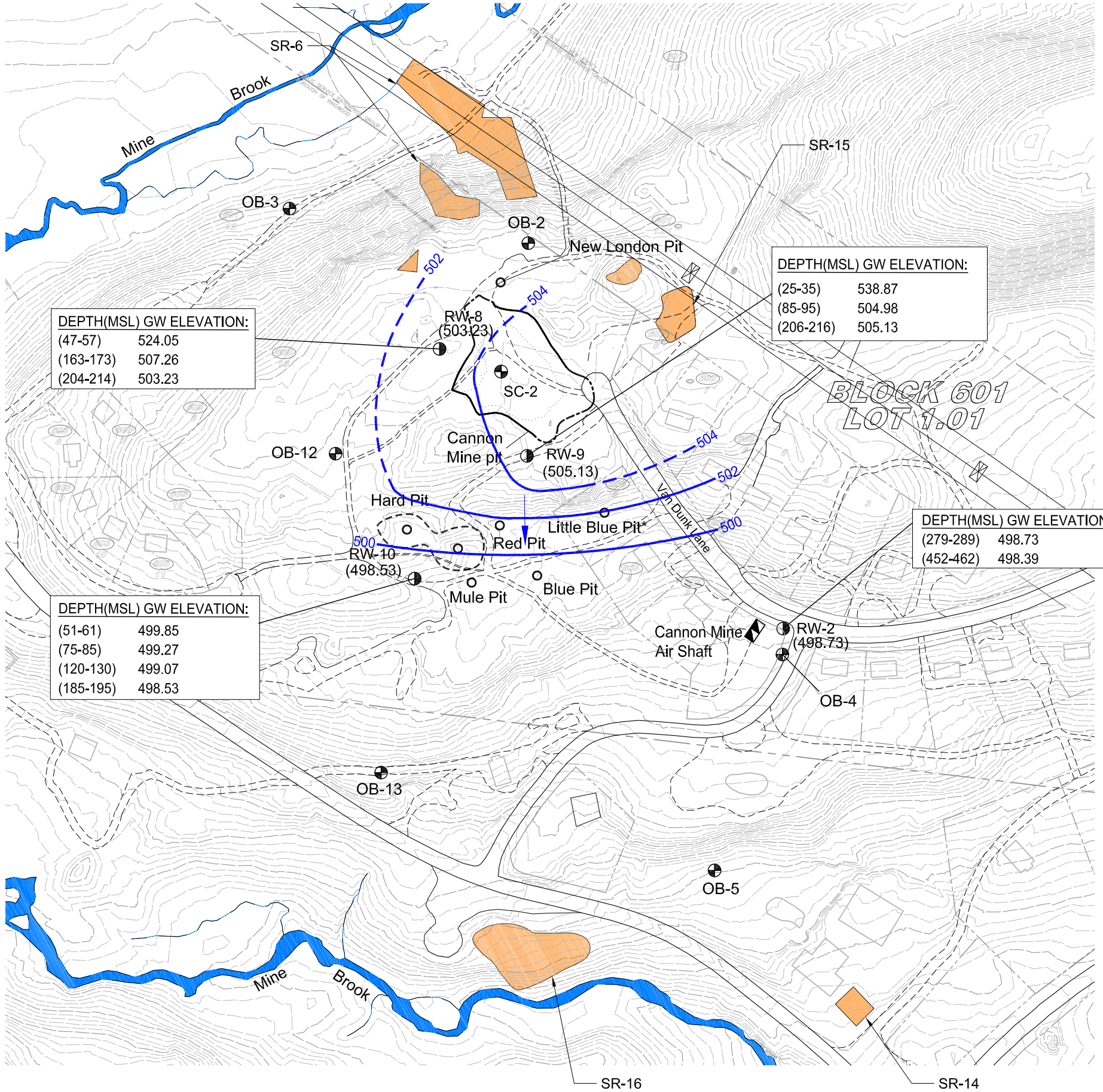


0 100 200 300
SCALE IN FEET

	Well ID	bottom screen depth (feet)	top screen depth (feet)	bottom screen depth (MSL)	top screen depth (MSL)	Monitoring Method
Monitors Cannon Mine Pit	SC-2	67	47	497.13	517.13	Low Flow
Shallow Bedrock	OB-2	42	8	520.3	554.3	Low Flow
	OB-3	24	9	472.53	487.53	Low Flow
	OB-4	61	28	449.8	482.8	Low Flow
	OB-5	63	18	395.83	440.83	Low Flow
	OB-12	40	9	518.36	549.36	Low Flow
	OB-13	60	8	440.35	492.35	Low Flow
	RW-8A(47-57)	57	47	512.55	522.55	ZIST Pump
	RW-9A(25-35)	35	25	526.82	536.82	ZIST Pump
	RW-9A(85-95)	95	85	466.73	476.73	ZIST Pump
	RW-10A(51-61)	61	51	478.43	488.43	ZIST Pump
	RW-10A(75-85)	85	75	454.45	464.45	ZIST Pump

LEGEND

- RESIDENCE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- GROUND SURFACE ELEVATION CONTOUR
- RW-10 (497.55) — BEDROCK MONITORING WELL WITH GROUNDWATER ELEVATION
- GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL (DEEP)
- GROUNDWATER FLOW DIRECTION OF DEEP BEDROCK INTERVAL SEPTEMBER 2014 (FT. MSL.) (2–FT CONTOUR INTERVAL)
- FT. MSL. – FEET ABOVE MEAN SEA LEVEL
- APPROXIMATE LIMITS OF PAINT SLUDGE REMOVAL AREAS
- WATER BODY
- STREAM

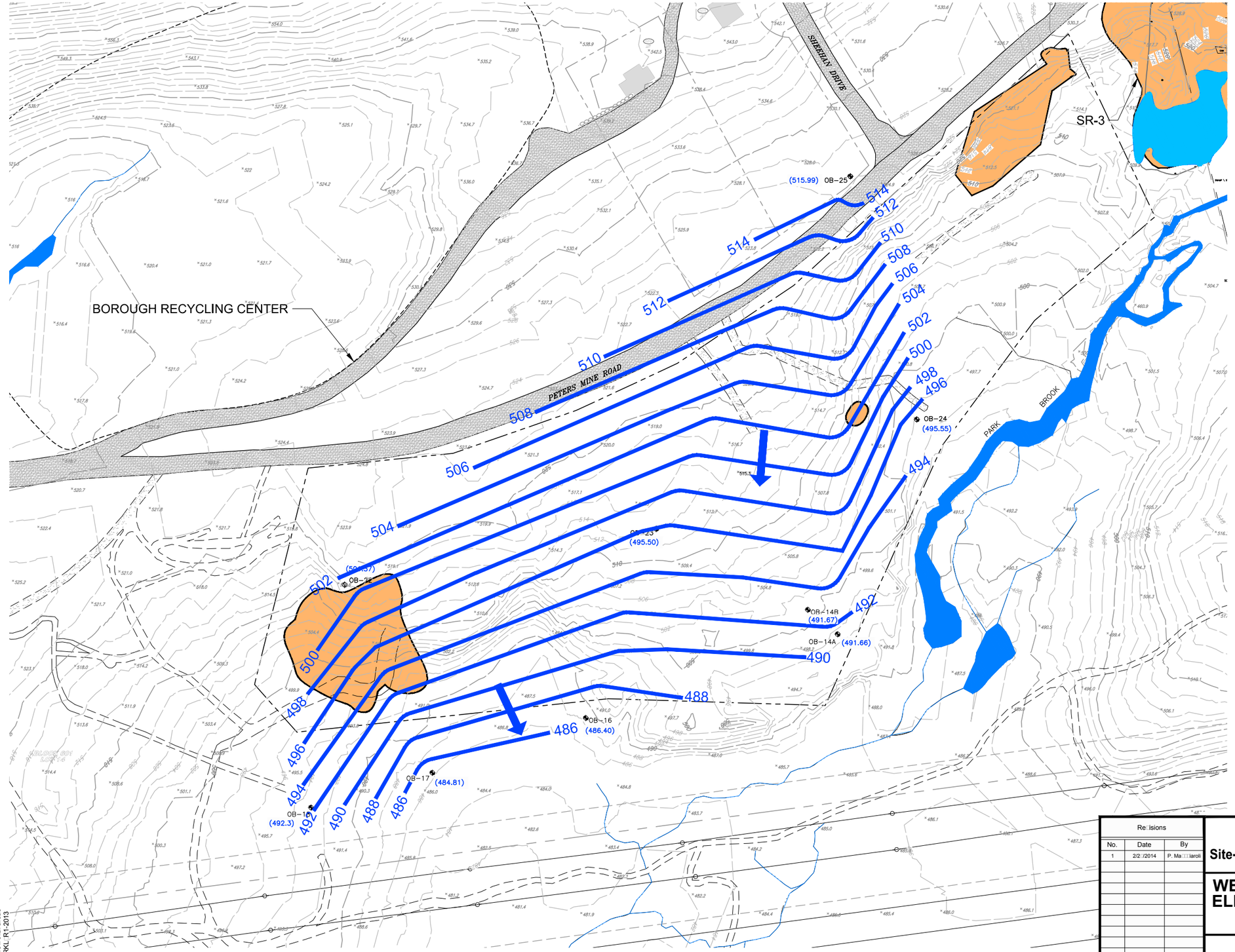
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND DEEP BEDROCK GROUNDWATER ELEVATION CONTOURS IN THE CMP - SEPTEMBER 2014

ARCADIS

FIGURE
13D

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=REF*
\\arcadis-us.com\officedata\Fairlawn-NJ\ENVCAD\Fairlawn\ACT - 2015\NJ000604\2014\00013\DWG\GW\FIG 13D -WELLS AND GW ELEVATION CONTOURS - 9-2014 - DEEP-BEDROCK.dwg LAYOUT: 13D SAVED: 1/7/2015 12:01 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE:
ARCADIS-MAHWAH.CTB PLOTTED: 1/7/2015 12:02 PM BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----



0 30 60 90
SCALE IN FEET

LEGEND:

- 530 — EXISTING CONTOUR
- 486 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL
- GROUNDWATER FLOW DIRECTION
- (495.55) GROUNDWATER LEVEL
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- OUTLINE OF O'CONNOR DISPOSAL AREA
- EXISTING DIRT ROAD/TRAIL
- OB-16 OVERBURDEN MONITORING WELL LOCATION
- OCDA O'CONNOR DISPOSAL AREA
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

Re□isions

No.	Date	By
1	2/2□/2014	P. Ma□□□laroli

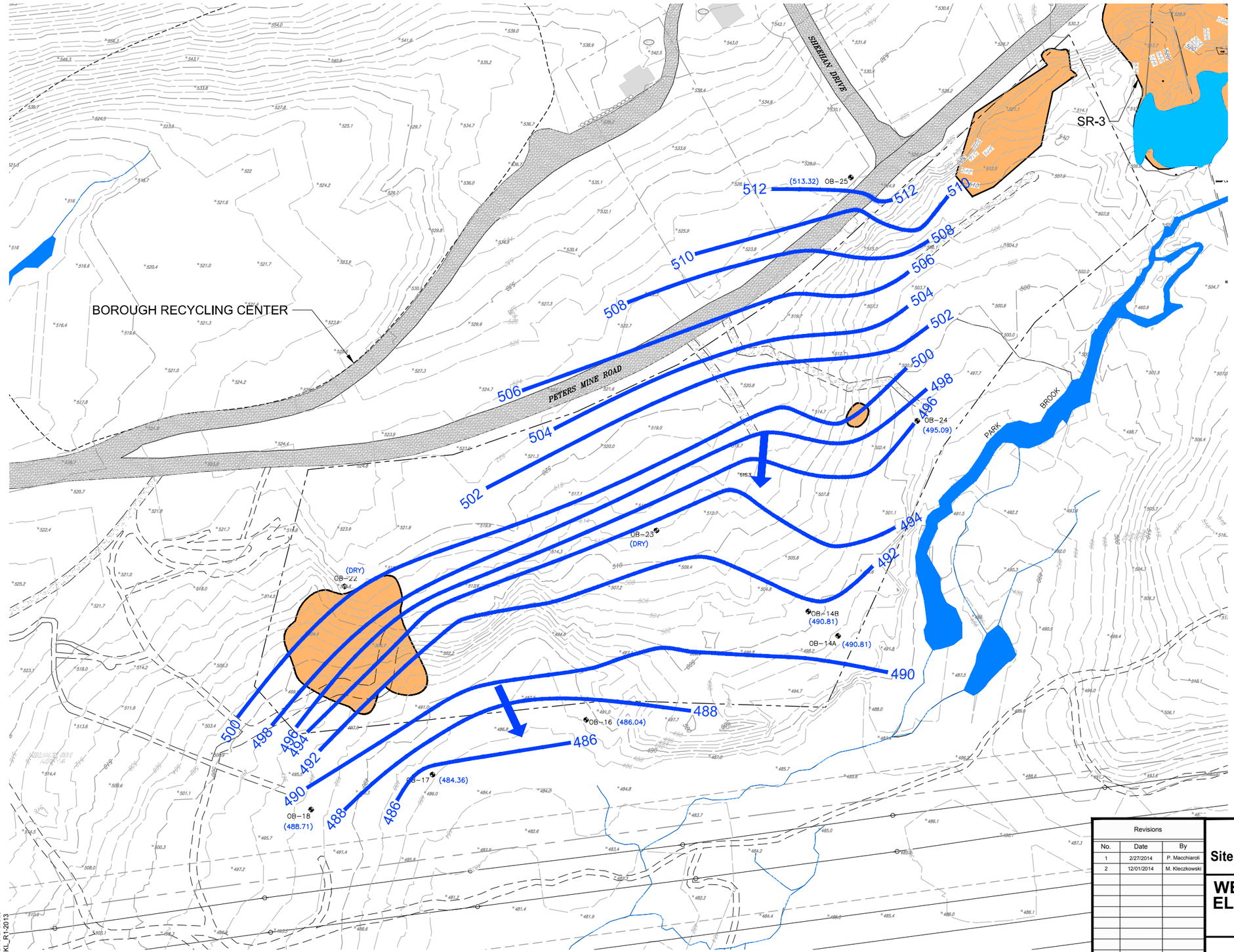
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND GROUNDWATER ELEVATION CONTOURS IN THE FORMER OCDA - APRIL 2012

ARCADIS

FIGURE
14

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GON'ALE□ LD:J.SEIER PIC:M.MOHIUDDIN PM:E□IMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Fairlawn\ACTNJ\00060412013\00035\2014-02\GW\FIG 14 WELLS AND GW ELEVATION CONTOURS - 04-2012 - OCDA.dwg LAYOUT: 14 SAVED: 2/25/2014 5:16 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 2/2□/2014 2:42 PM
BY: GON'ALE□, JAMES PROJECTNAME: ----
XREFS: IMAGES:
OCDA-AR-00
sl□dge re□□o□al areas
2182BRKL□R1-2013



0 30 60 90
SCALE IN FEET

LEGEND:

- EXISTING CONTOUR
- 485 GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL
- GROUNDWATER FLOW DIRECTION
- (484.90) GROUNDWATER LEVEL
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- OUTLINE OF O'CONNOR DISPOSAL AREA
- EXISTING DIRT ROAD/TRAIL
- OB-16 OVERBURDEN MONITORING WELL LOCATION
- OCDA O'CONNOR DISPOSAL AREA
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	12/01/2014	M. Kleczkowski

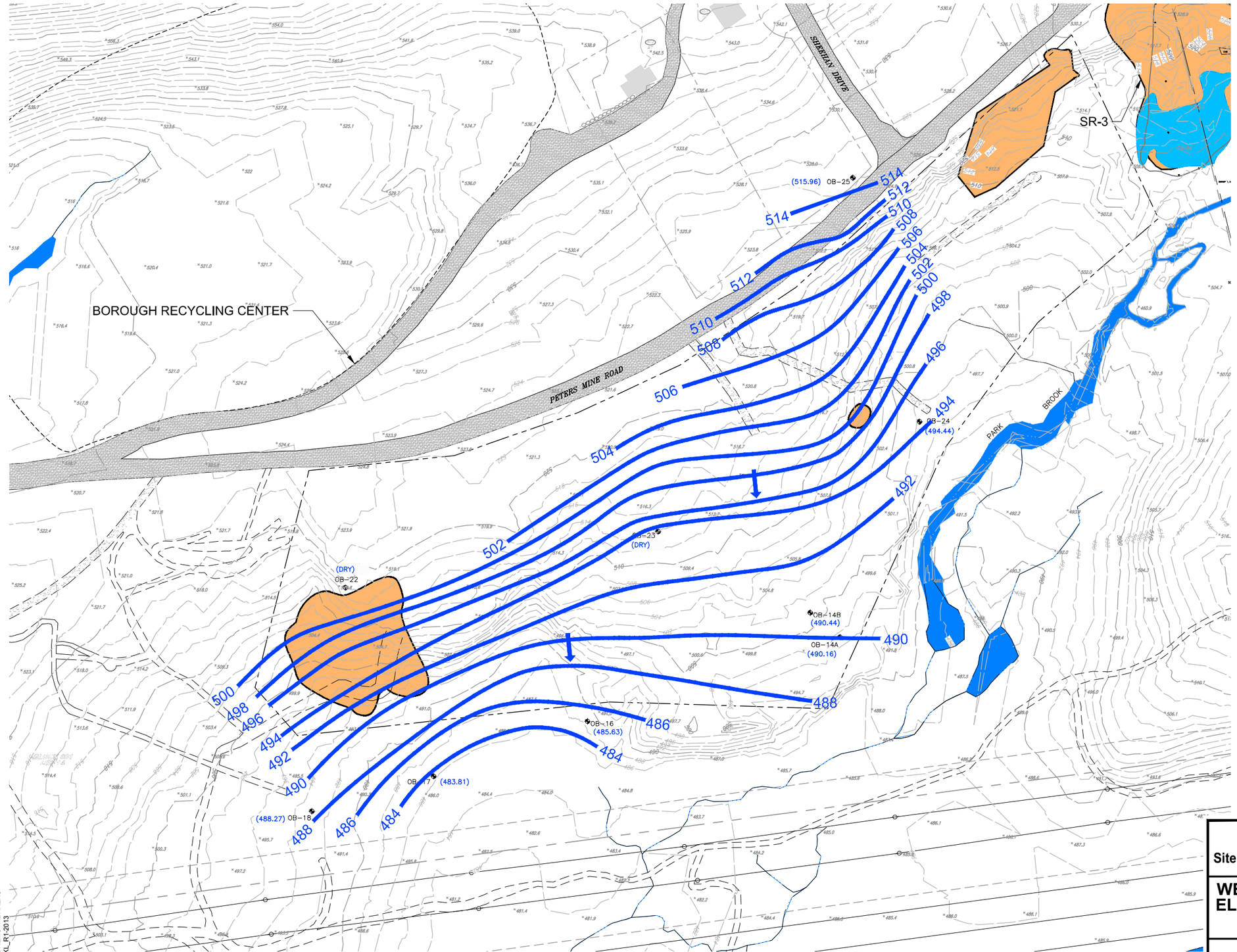
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

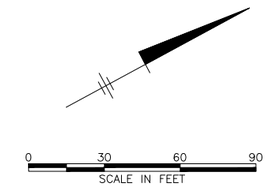
WELL LOCATIONS AND GROUNDWATER ELEVATION CONTOURS IN THE FORMER OCDA - NOVEMBER 2013

ARCADIS

FIGURE
15A

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACTRETURN-TO\Fairlawn-NJ\NJ000604\2014\00011\GWRIR\FIG 15A -WELLS AND GW ELEVATION CONTOURS - 11-2013 - OCDA.dwg LAYOUT: 15A SAVED: 12/1/2014 4:48 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB
PLOTTED: 12/1/2014 4:49 PM BY: WASILEWSKI, MATT
XREFS: OCDA-AR-00 IMAGES: sludge removal areas 2182BRKL_R1-2013 PROJECTNAME: ----





LEGEND:

- 530 — EXISTING CONTOUR
- 514 — GROUNDWATER CONTOUR LINE RELATIVE TO MEAN SEA LEVEL
- GROUNDWATER FLOW DIRECTION
- (484.90) GROUNDWATER LEVEL
- LIMIT OF SURFACE WATER
- OVERHEAD UTILITY LINES
- PROPERTY BOUNDARY
- OUTLINE OF O'CONNOR DISPOSAL AREA
- EXISTING DIRT ROAD/TRAIL
- OB-16 — OVERBURDEN MONITORING WELL LOCATION
- OCDA — O'CONNOR DISPOSAL AREA
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- INDICATES VERNAL CONDITIONS TYPICALLY OBSERVED IN THE SPRING AND FALL SEASONS
- WATER BODY
- STREAM

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

WELL LOCATIONS AND GROUNDWATER ELEVATION CONTOURS IN THE FORMER OCDA - SEPTEMBER 2014

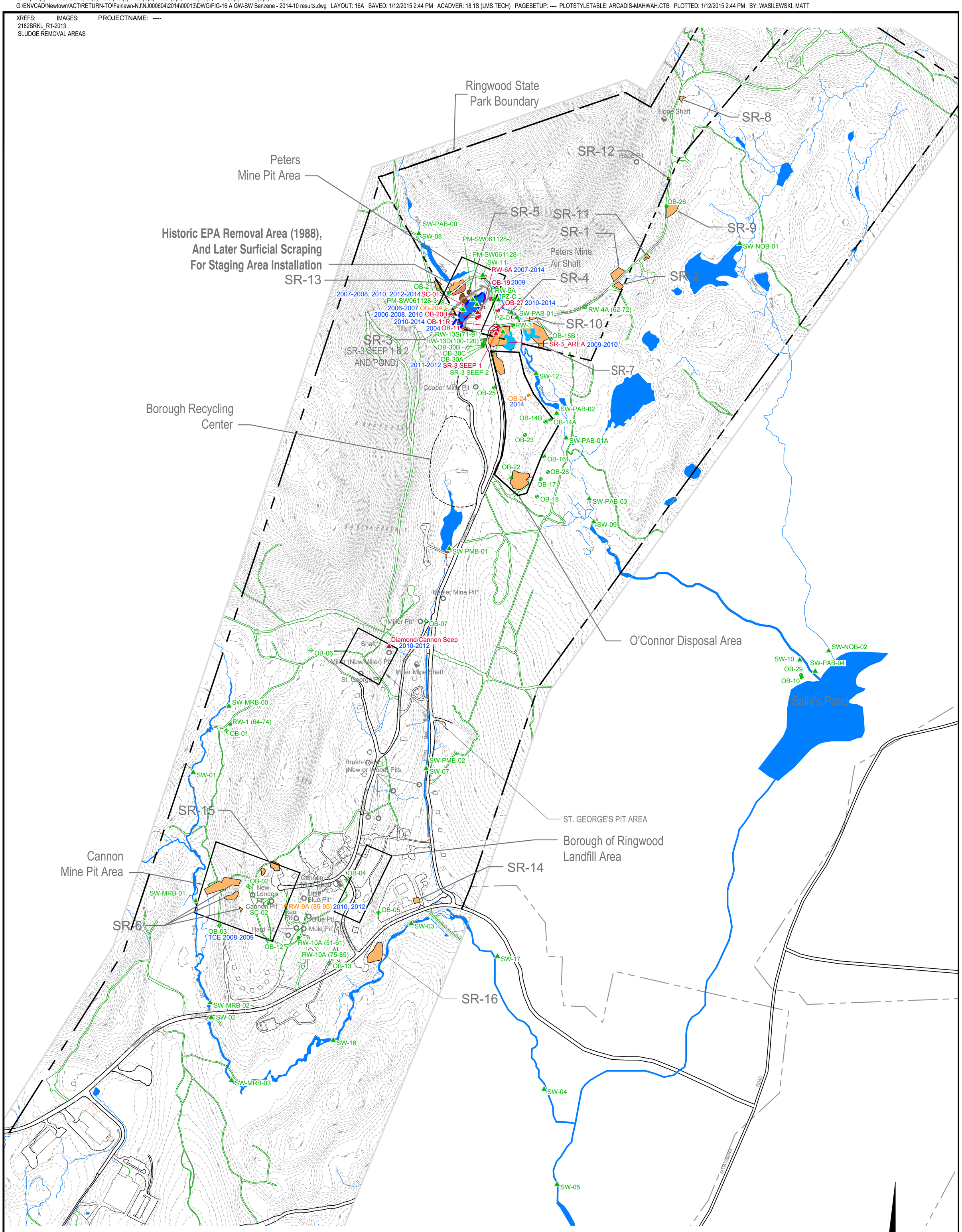
ARCADIS

FIGURE
15B

CITY:MAHWAH DIV/GROUP:ENVIRONMENTAL DB:J.GONZALEZ LD:J.SEIER PIC:M.MOHIUDDIN PM:E.ZIMMERMAN TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
\\arcadis-us.com\officedata\Fairlawn-NJ\ENVCAD\Fairlawn\ACT - 2015\NJ000694\2014\00013\DWG\GW\FIG 15B -WELLS AND GW ELEVATION CONTOURS - 9-2014 - OCDA.dwg LAYOUT: 15B SAVED: 1/7/2015 1:31 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE:
ARCADIS:MAHWAH.CTB PLOTTED: 1/7/2015 1:32 PM BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----
OCDA-AR-00
SLUDGE REMOVAL AREAS
2182BRKL_R1-2013

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00013\DWG\FIG-16 A GW-SW Benzene - 2014-10 results.dwg LAYOUT: 16A SAVED: 1/12/2015 2:44 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/12/2015 2:44 PM BY: WASILEWSKI, MATT

XREFS: IMAGES: PROJECTNAME: ----
2182BRKL_R1-2013
SLUDGE REMOVAL AREAS



LEGEND

- BEDROCK WELL
- DEEP BEDROCK WELL
- DIRECTIONAL WELL
- UNCONSOLIDATED WELL
- SW/SD-2 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION
- SW/SD-MRB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM MINE BROOK
- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
- SW/SD-NOB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM NORTH BROOK
- SW/SD-PAB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
- SW/SD-12 — GREEN – BENZENE NOT DETECTED AT A CONCENTRATION ABOVE LABORATORY METHOD DETECTION LIMITS
- RW-11 — YELLOW – BENZENE DETECTED AT A CONCENTRATION BELOW THE NJDEP GROUNDWATER QUALITY CRITERIA
- OB-22 — RED – BENZENE DETECTED AT A CONCENTRATION ABOVE THE NJDEP GROUNDWATER QUALITY CRITERIA
- 2006-2007 — DATE OF EXCEEDANCE/DETECTION
- TCE — TRICHLOROETHENE
- TRAIL/ DIRT ROAD
- STREAM
- INFERRED STREAM
- TOP OF BEDROCK PIT WITHIN PETERS MINE PIT
- TOP OF SLOPE TO MINE PIT WITHIN PETERS MINE PIT, ELEVATION 525 FT MSL (1961)
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREA – SOIL, DRUMS, AND DRUM REMNANTS
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL AND PAINT SLUDGE
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NOTES:
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2. ALL RESULTS ARE PRESENTED AS MICROGRAM PER LITER (µg/L).
3. EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE-WIDE BENZENE DETECTIONS IN SURFACE WATER, OVERBURDEN, AND SHALLOW BEDROCK - NOVEMBER 2004 THROUGH OCTOBER 2014

ARCADIS

FIGURE
16A

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00013\DWG\FIG-16 B Bedrock Benzene - 2014-10 results.dwg LAYOUT: 16B SAVED: 1/12/2015 2:41 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/12/2015 2:43 PM BY: WASILEWSKI, MATT

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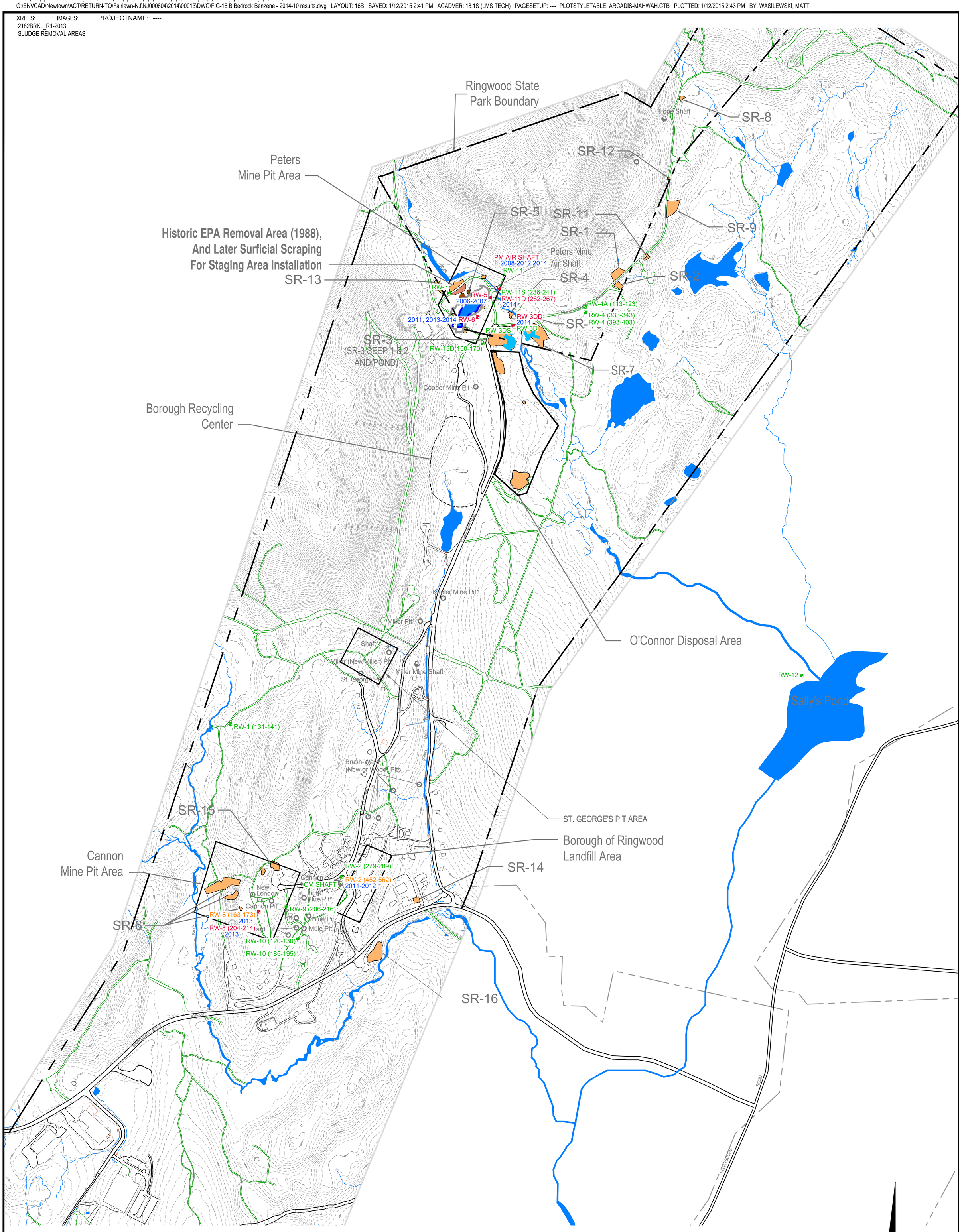
2182BRKL_R1-2013
SLUDGE REMOVAL AREAS



LEGEND

- BEDROCK WELL
- DEEP BEDROCK WELL
- DIRECTIONAL WELL
- UNCONSOLIDATED WELL
- SW/SD-2 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION
- SW/SD-MRB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM MINE BROOK
- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
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- RW-11 — YELLOW – BENZENE DETECTED AT A CONCENTRATION BELOW THE NJDEP GROUNDWATER QUALITY CRITERIA
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- 2006-2007 — DATE OF EXCEEDANCE/DETECTION
- TRAIL/ DIRT ROAD
- STREAM
- INFERRED STREAM
- TOP OF BEDROCK PIT WITHIN PETERS MINE PIT
- TOP OF SLOPE TO MINE PIT WITHIN PETERS MINE PIT, ELEVATION 525 FT MSL (1961)
- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
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Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE-WIDE BENZENE DETECTIONS IN DEEP BEDROCK - NOVEMBER 2004 THROUGH OCTOBER 2014

ARCADIS

FIGURE
16B

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00013\DWG\FIG-17 A GW-SW Lead - 2014-09 results.dwg LAYOUT: 17A SAVED: 1/12/2015 2:46 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/12/2015 2:46 PM BY: WASILEWSKI, MATT

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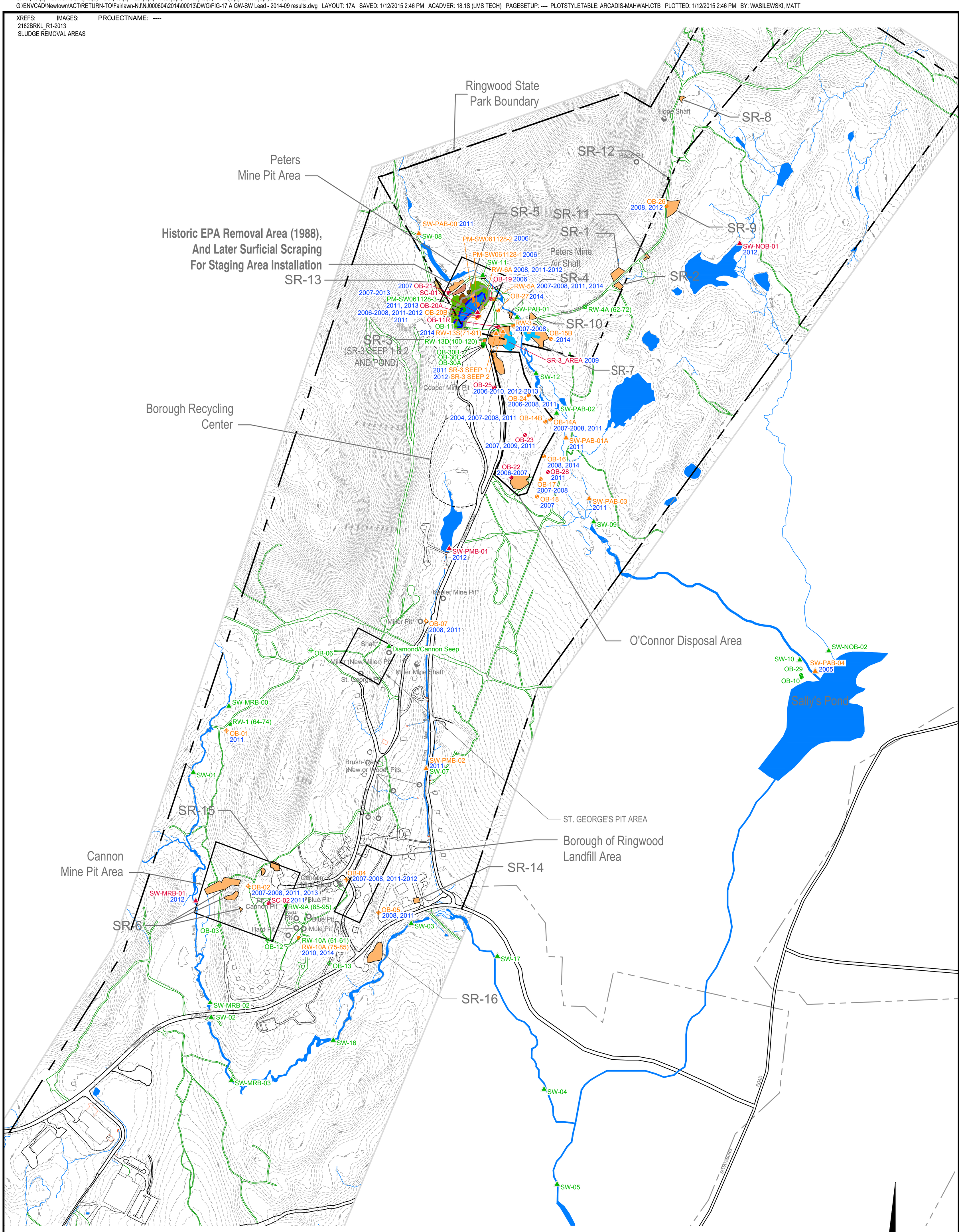
2182BRKL_R1-2013
SLUDGE REMOVAL AREAS



LEGEND

- BEDROCK WELL
- DEEP BEDROCK WELL
- DIRECTIONAL WELL
- UNCONSOLIDATED WELL
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- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
- SW/SD-NOB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM NORTH BROOK
- SW/SD-PAB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
- SW/SD-12 — GREEN – NON DETECT
- RW-11 — YELLOW – DETECT
- OB-22 — RED – EXCEEDANCE
- 2006-2007 — DATE OF EXCEEDANCE/DETECTION
- TRAIL/ DIRT ROAD
- STREAM
- INFERRED STREAM
- TOP OF BEDROCK PIT WITHIN PETERS MINE PIT
- TOP OF SLOPE TO MINE PIT WITHIN PETERS MINE PIT, ELEVATION 525 FT MSL (1961)
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Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

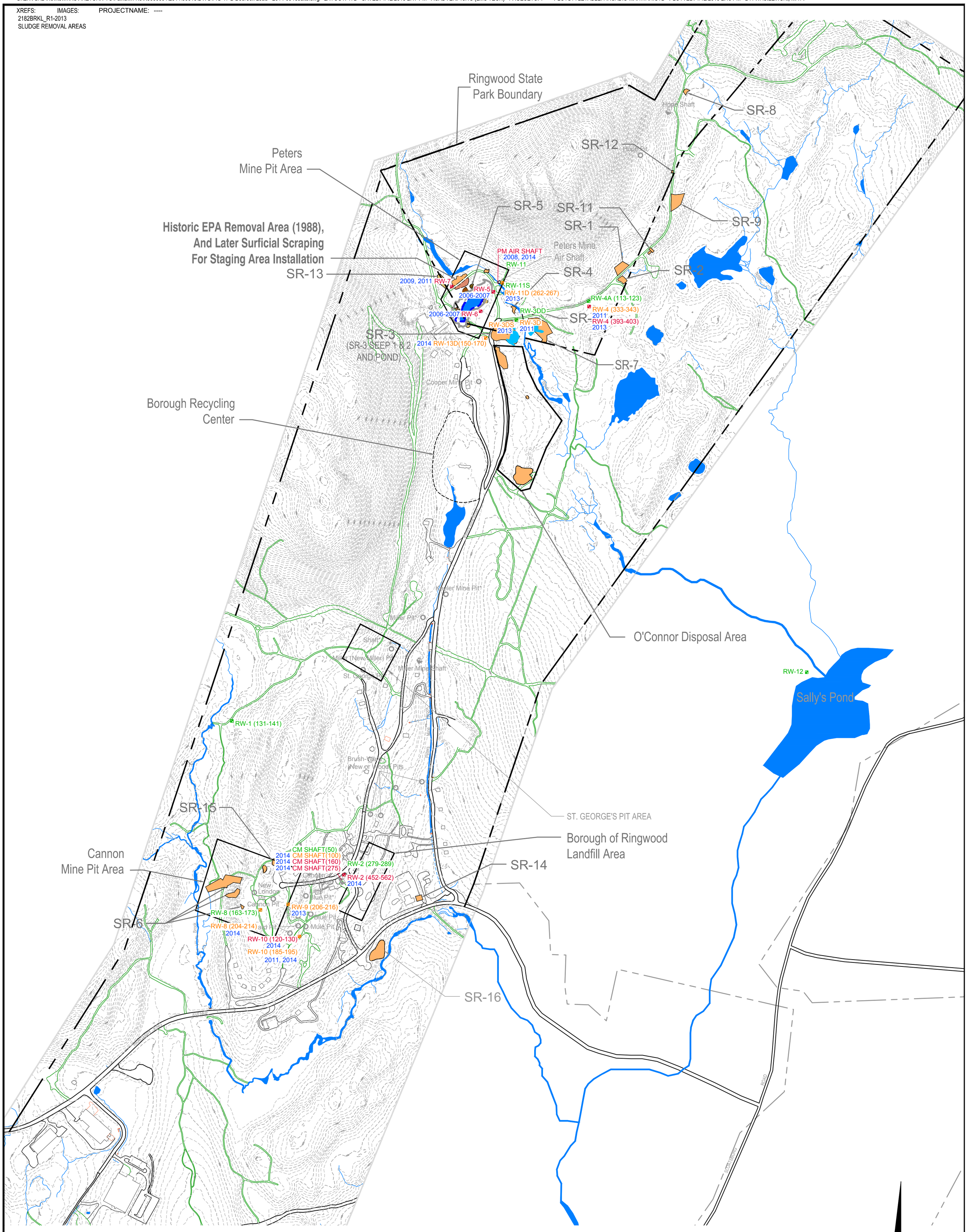
SITE-WIDE LEAD DETECTIONS IN SURFACE WATER, OVERBURDEN, AND SHALLOW BEDROCK - NOVEMBER 2004 THROUGH SEPTEMBER 2014

ARCADIS

FIGURE
17A

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00013\DWG\FIG-17 B Bedrock Lead - 2014-09 results.dwg LAYOUT: 17B SAVED: 1/12/2015 2:47 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/12/2015 2:48 PM BY: WASILEWSKI, MATT

XREFS: IMAGES: PROJECTNAME: ----
2182BRKL_R1-2013
SLUDGE REMOVAL AREAS



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- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
- SW/SD-NOB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM NORTH BROOK
- SW/SD-PAB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
- SG-1 — STAFF GUAGE
- SW/SD-12 — GREEN – NON DETECT
- RW-11 — YELLOW – DETECT
- OB-22 — RED – EXCEEDANCE
- 2006-2007 — DATE OF EXCEEDANCE/DETECTION
- TRAIL/ DIRT ROAD
- STREAM
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- TOP OF SLOPE TO MINE PIT WITHIN PETERS MINE PIT, ELEVATION 525 FT MSL (1961)
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- APPROXIMATE LIMITS OF REMOVAL AREAS – SOIL, PAINT SLUDGE, AND DRUM REMNANTS
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0 400' 800'
GRAPHIC SCALE

Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE-WIDE LEAD DETECTIONS IN DEEP BEDROCK - NOVEMBER 2004 THROUGH SEPTEMBER 2014

ARCADIS

FIGURE
17B

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00013\DWG\FIG-18 A GW-SW Arsenic - 2014-09 results.dwg LAYOUT: 18A SAVED: 1/12/2015 2:51 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/12/2015 2:52 PM BY: WASILEWSKI, MATT

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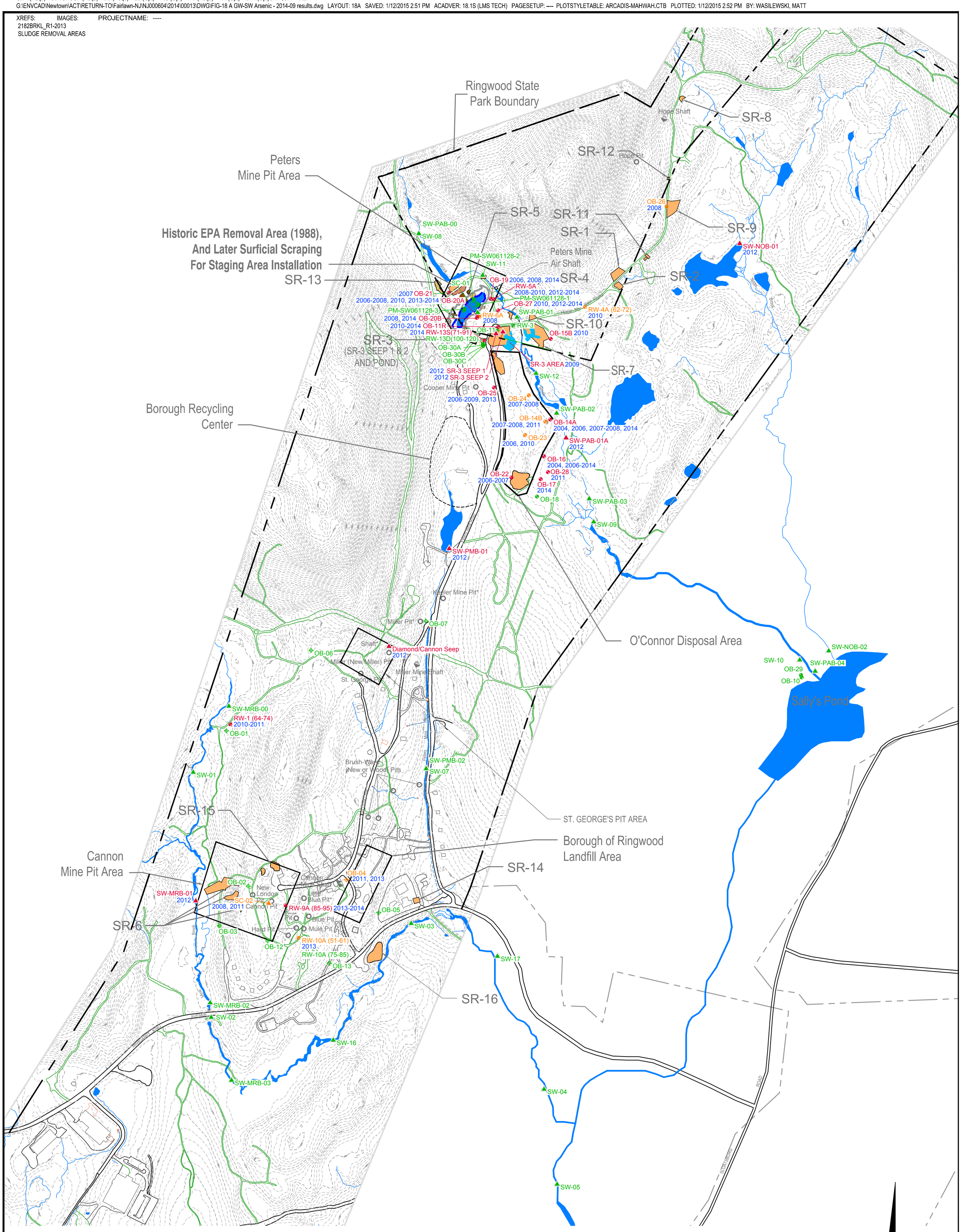
2182BRKL_R1-2013
SLUDGE REMOVAL AREAS



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- SW/SD-PAB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
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Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE-WIDE ARSENIC DETECTIONS IN SURFACE WATER, OVERBURDEN, AND SHALLOW BEDROCK - NOVEMBER 2004 THROUGH SEPTEMBER 2014

ARCADIS

FIGURE
18A

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2014\00013\DWG\FIG-18 B BEDROCK Arsenic - 2014-09 results.dwg LAYOUT: 18B SAVED: 1/12/2015 2:53 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/12/2015 2:54 PM BY: WASILEWSKI, MATT

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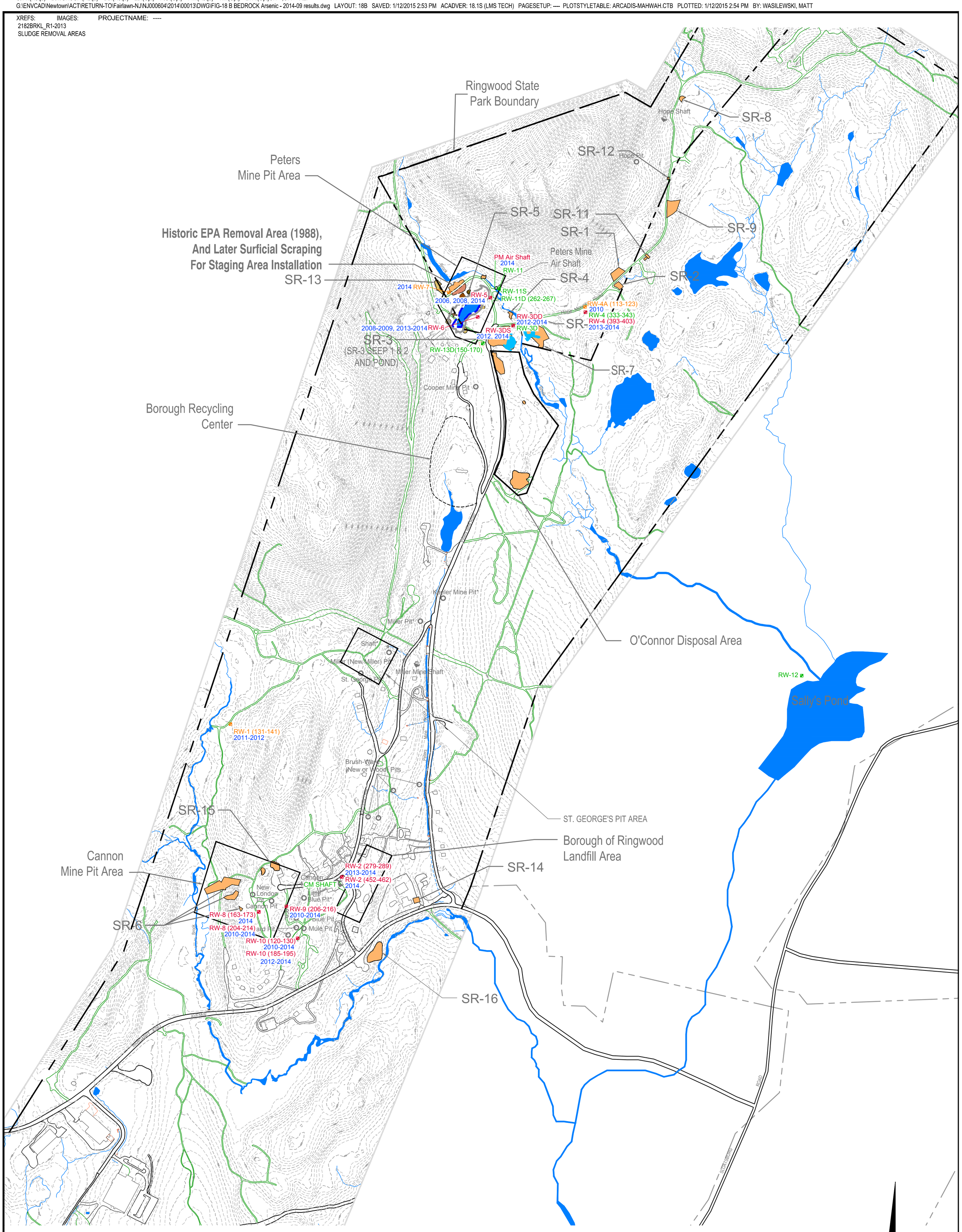
2182BRKL_R1-2013
SLUDGE REMOVAL AREAS



LEGEND

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- UNCONSOLIDATED WELL
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- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
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- SW/SD-PAB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
- SW/SD-12 — GREEN – NON DETECT
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- 2006-2007 — DATE OF EXCEEDANCE/DETECTION
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Revisions

No.	Date	By
1	2/27/2014	P. Macchiaroli
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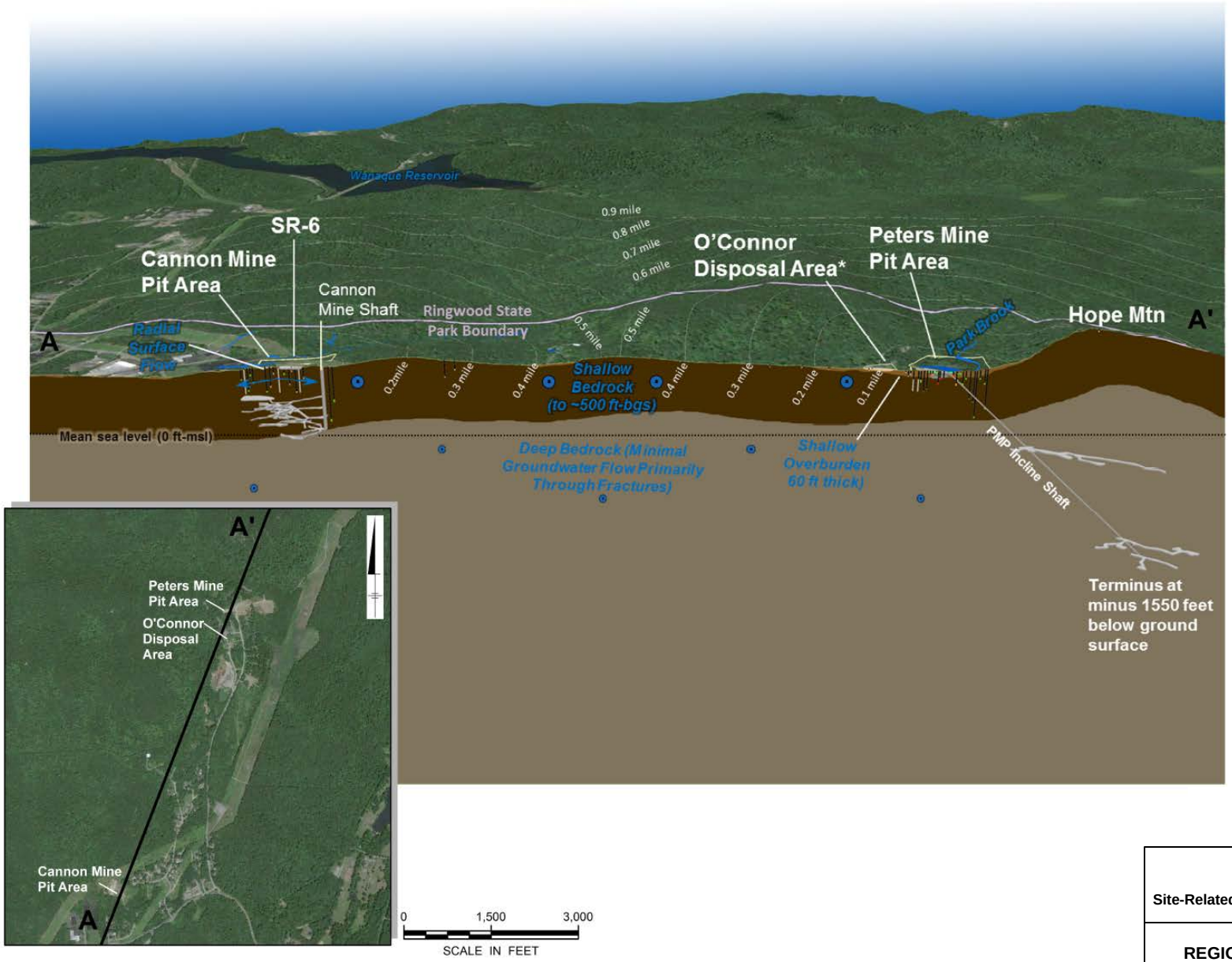
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

SITE-WIDE ARSENIC DETECTIONS IN DEEP BEDROCK - NOVEMBER 2004 THROUGH SEPTEMBER 2014

ARCADIS

FIGURE
18B



Shallow Overburden
Shallow Bedrock
Deep Bedrock
Groundwater Monitor Well Riser
Groundwater Monitor Well Screen
Mine Workings
Groundwater Flow Direction
1) Toward Viewer
2) Size of symbol indicates flow rate
Benzene Not Sampled
Green - Benzene not detected at a concentration above labratory method detection limits
Yellow - Benzene detected at a concentration below the NJDEP groundwater quality criteria
Red - Benzene detected at a concentration above the NJDEP groundwater quality criteria

NOTES:
* - O'Connor Disposal Area and all wells are projected onto the cross-section.
ft-bgs - feet below ground surface
ft-msl - feet above mean seal level

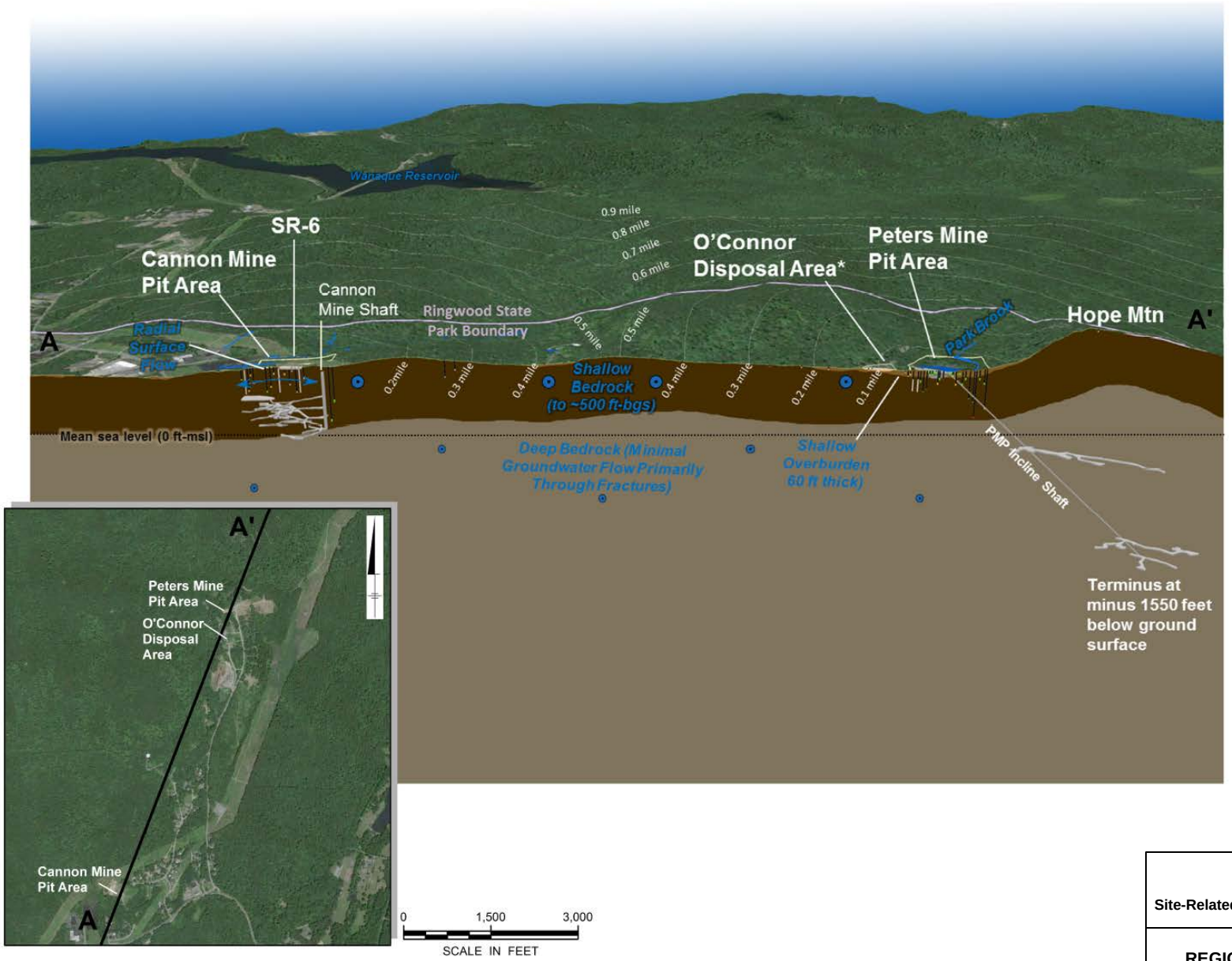
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

REGIONAL SITES CROSS SECTION WITH BENZENE CONCENTRATION LEVEL

ARCADIS

FIGURE 19

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Figures 19, 20, 21_022614.pptx



Shallow Overburden
Shallow Bedrock
Deep Bedrock
Groundwater Monitor Well Riser
Groundwater Monitor Well Screen
Mine Workings
Groundwater Flow Direction
1) Toward Viewer
2) Size of symbol indicates flow rate
Lead Not Sampled
Green - Lead not detected at a concentration above labratory method detection limits
Yellow - Lead detected at a concentration below the NJDEP groundwater quality criteria
Red - Lead detected at a concentration above the NJDEP groundwater quality criteria

NOTES:
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ft-bgs - feet below ground surface
ft-msl - feet above mean seal level

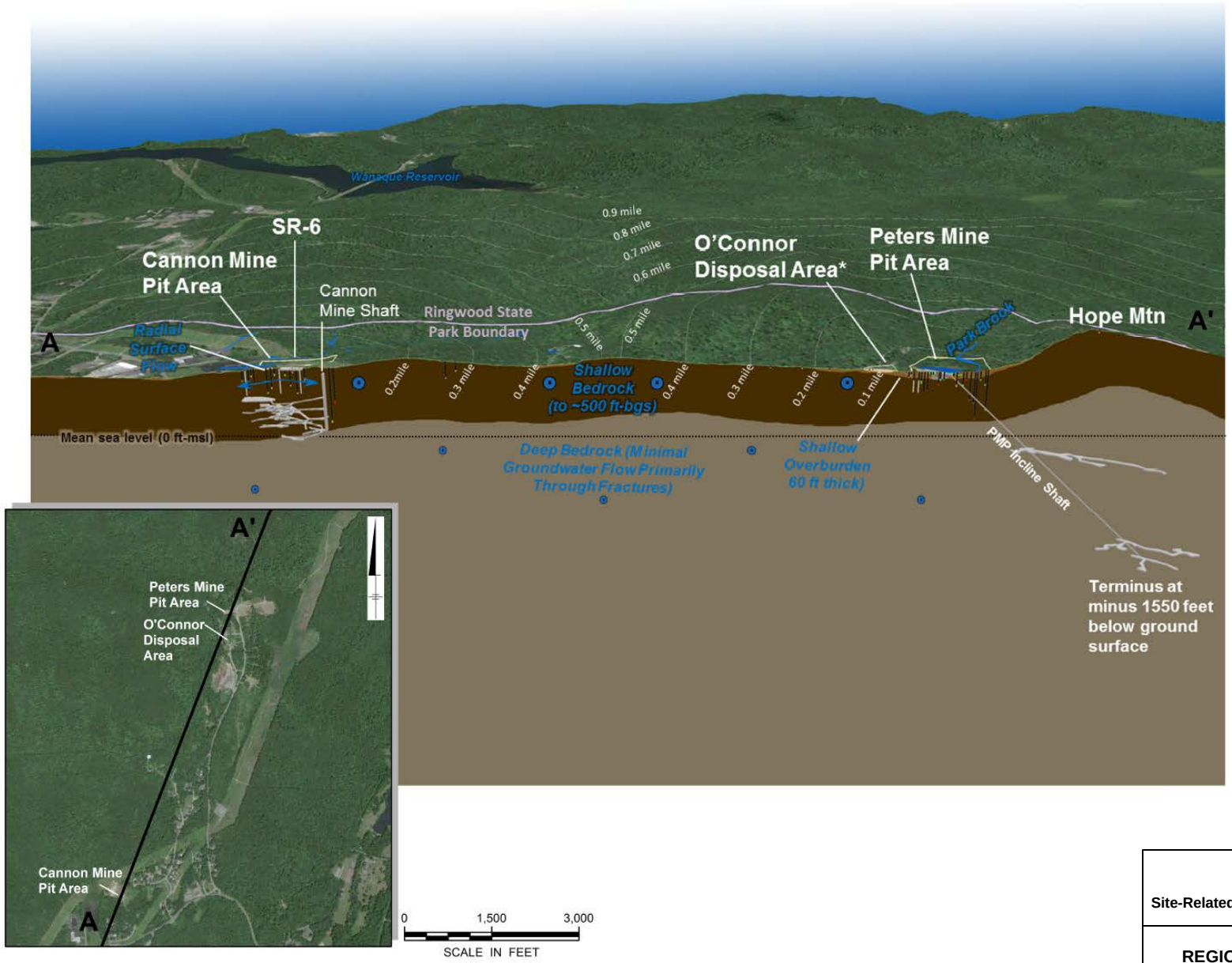
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

REGIONAL SITES CROSS SECTION WITH LEAD CONCENTRATION LEVEL

ARCADIS

FIGURE 20

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Figures 19, 20, 21_022614.pptx



Shallow Overburden
Shallow Bedrock
Deep Bedrock
Groundwater Monitor Well Riser
Groundwater Monitor Well Screen
Mine Workings
Groundwater Flow Direction
1) Toward Viewer
2) Size of symbol indicates flow rate
Arsenic Not Sampled
Green - Arsenic not detected at a concentration above labratory method detection limits
Yellow - Arsenic detected at a concentration below the NJDEP groundwater quality criteria
Red - Arsenic detected at a concentration above the NJDEP groundwater quality criteria

NOTES:
* - O'Connor Disposal Area and all wells are projected onto the cross-section.
ft-bgs - feet below ground surface
ft-msl - feet above mean seal level

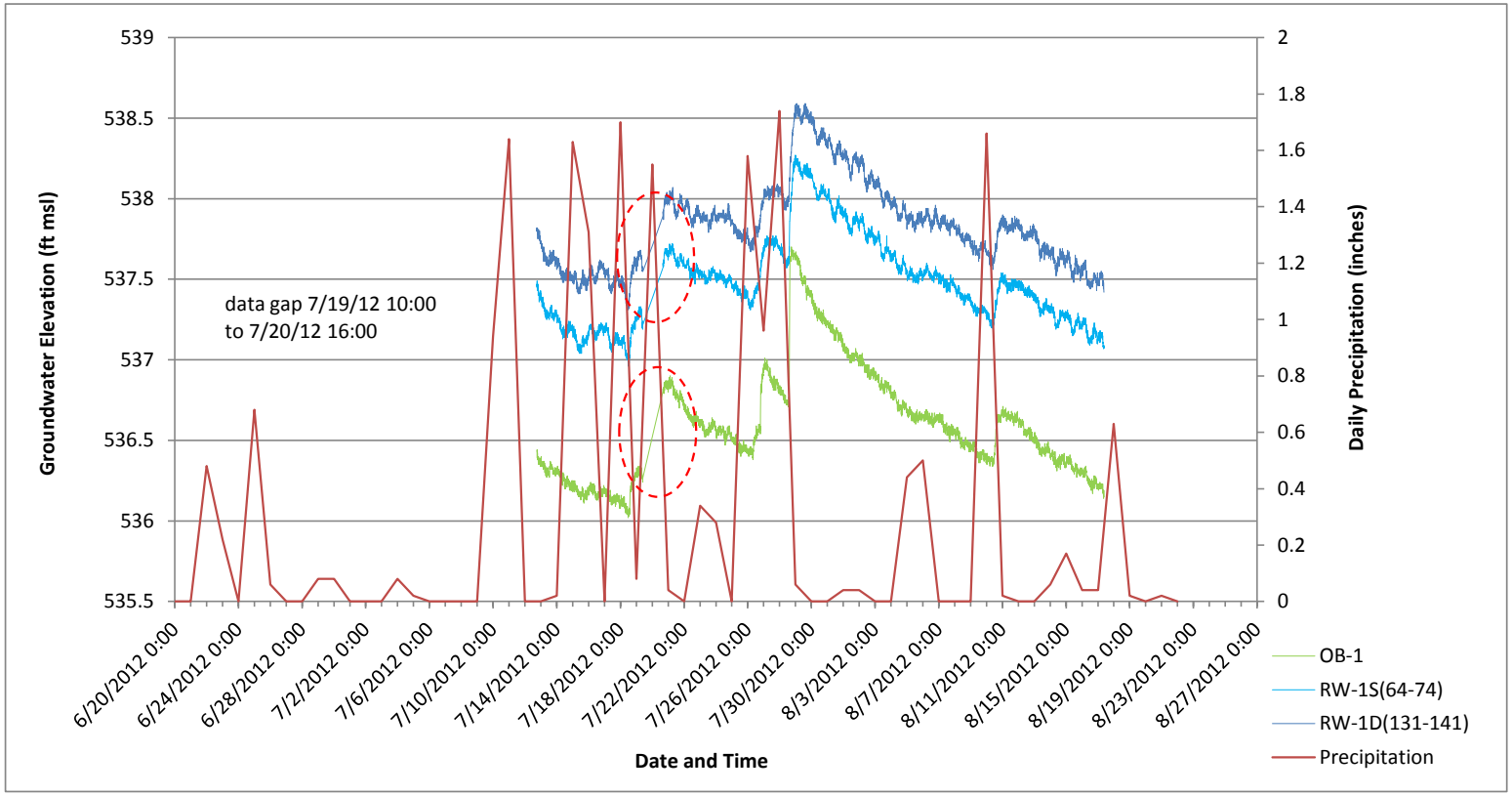
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

REGIONAL SITES CROSS SECTION WITH ARSENIC CONCENTRATION LEVEL

ARCADIS

FIGURE 21

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Figures 19, 20, 21_022614.pptx



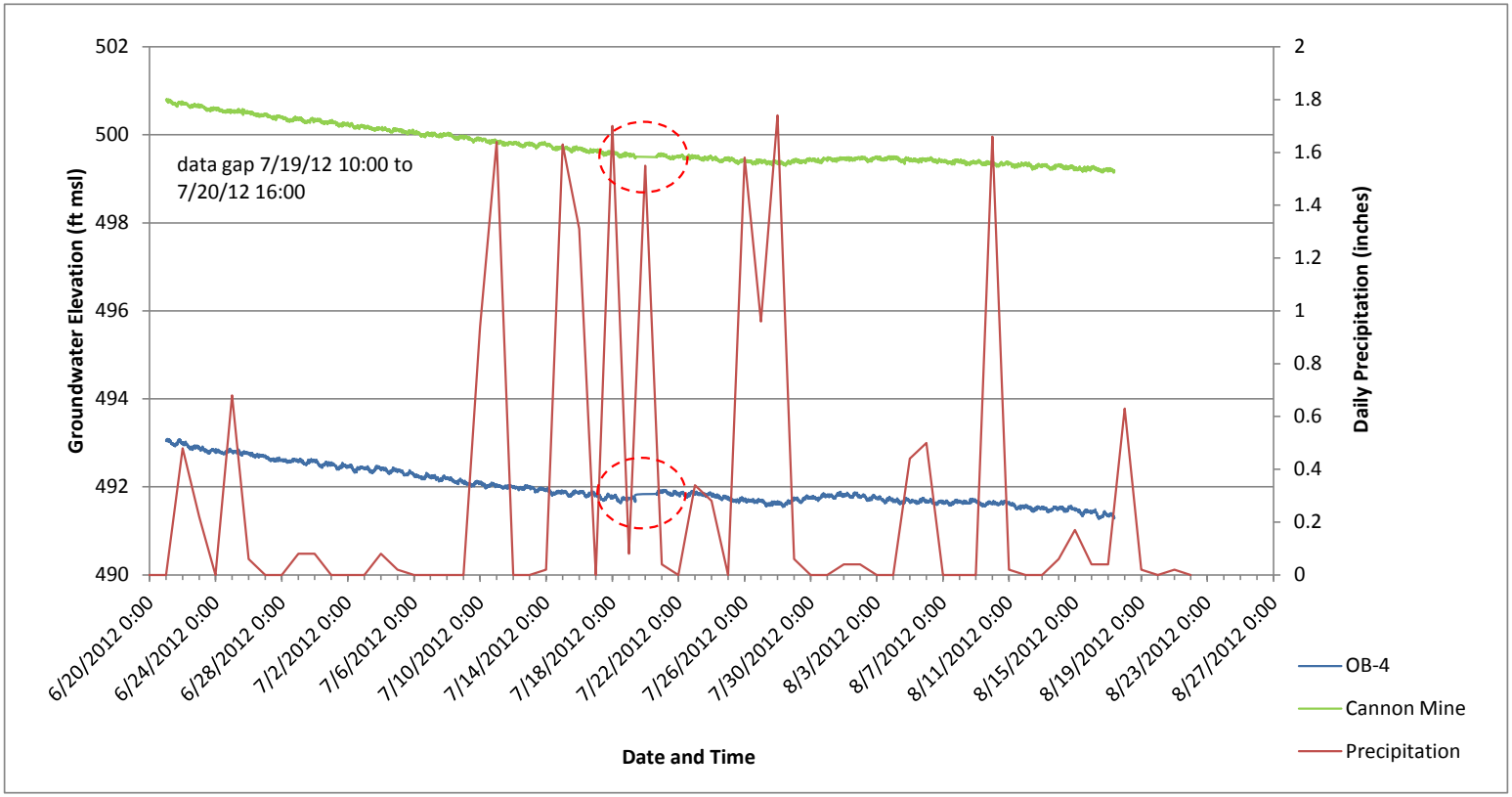
CMP: Canon Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Vertical Hydraulic Gradients
CMP Area

ARCADIS

Figure
22A



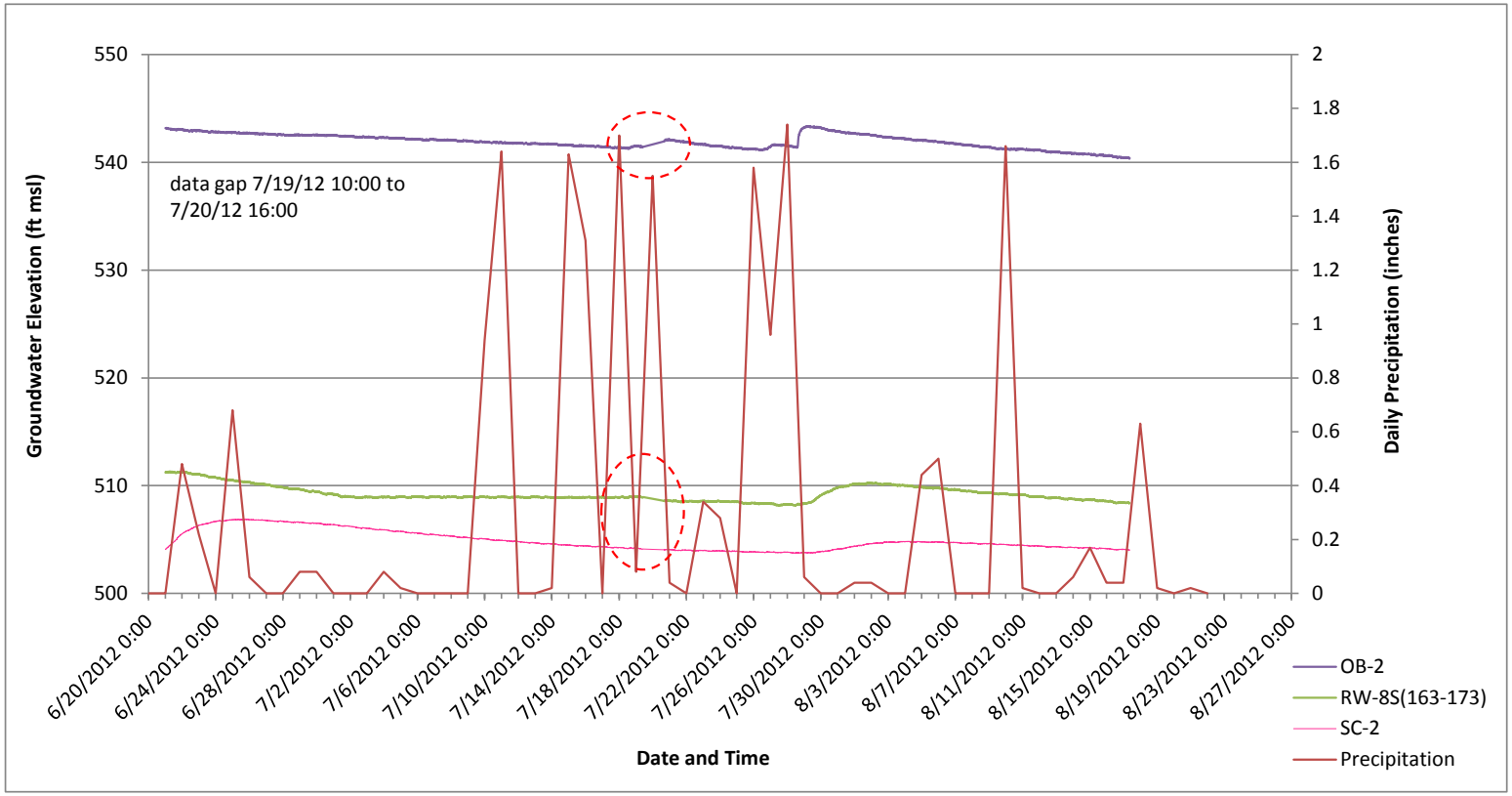
CMP: Canon Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Vertical Hydraulic Gradients
CMP Area

ARCADIS

Figure
22B



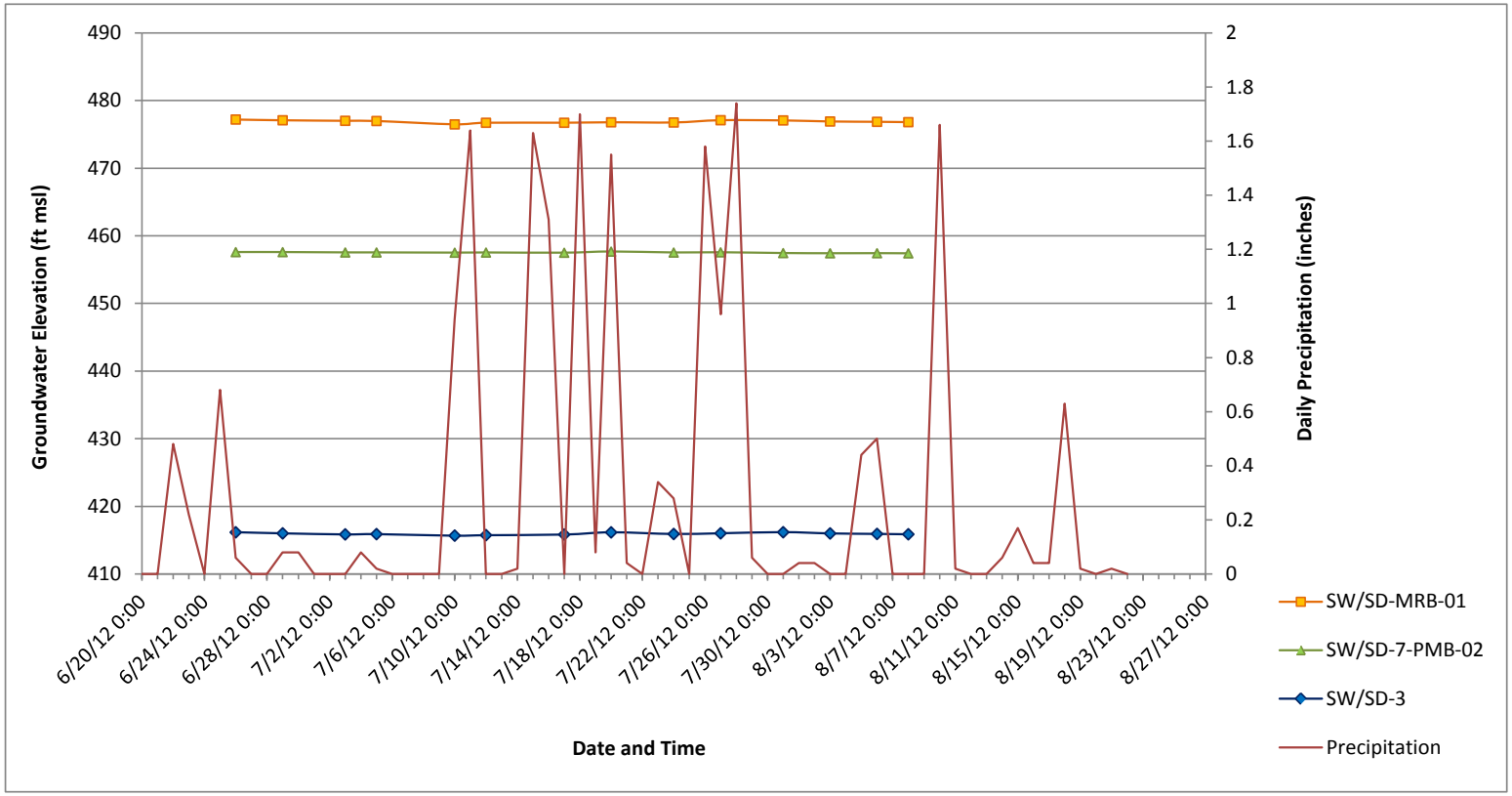
CMP: Canon Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Vertical Hydraulic Gradients
CMP Area

ARCADIS

Figure
22C



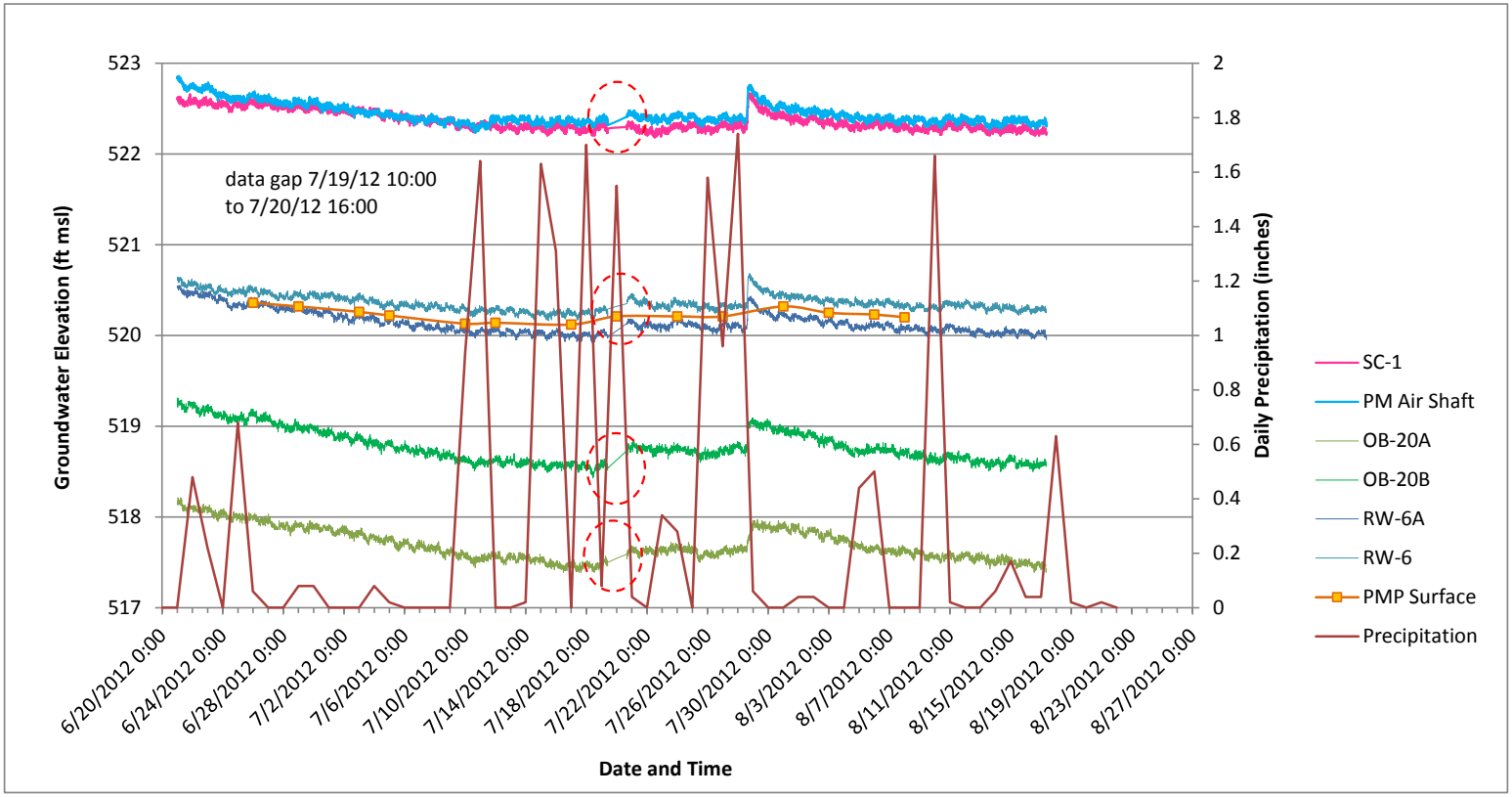
CMP: Canon Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Surface Water Elevations
CMP Area

ARCADIS

Figure
23



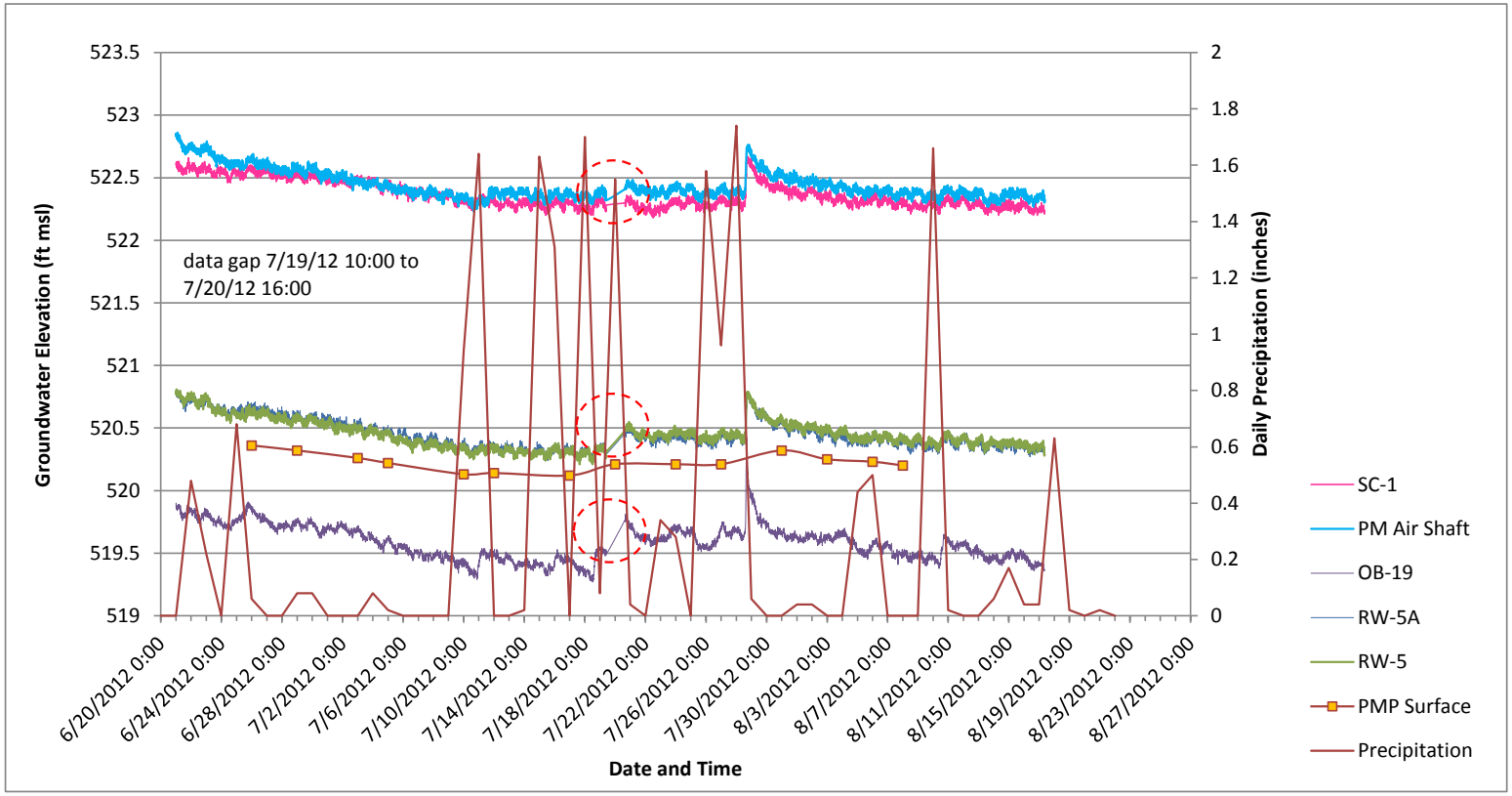
PMP: Peters Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Vertical Hydraulic Gradients, Overburden PMP Area

ARCADIS

Figure
24A



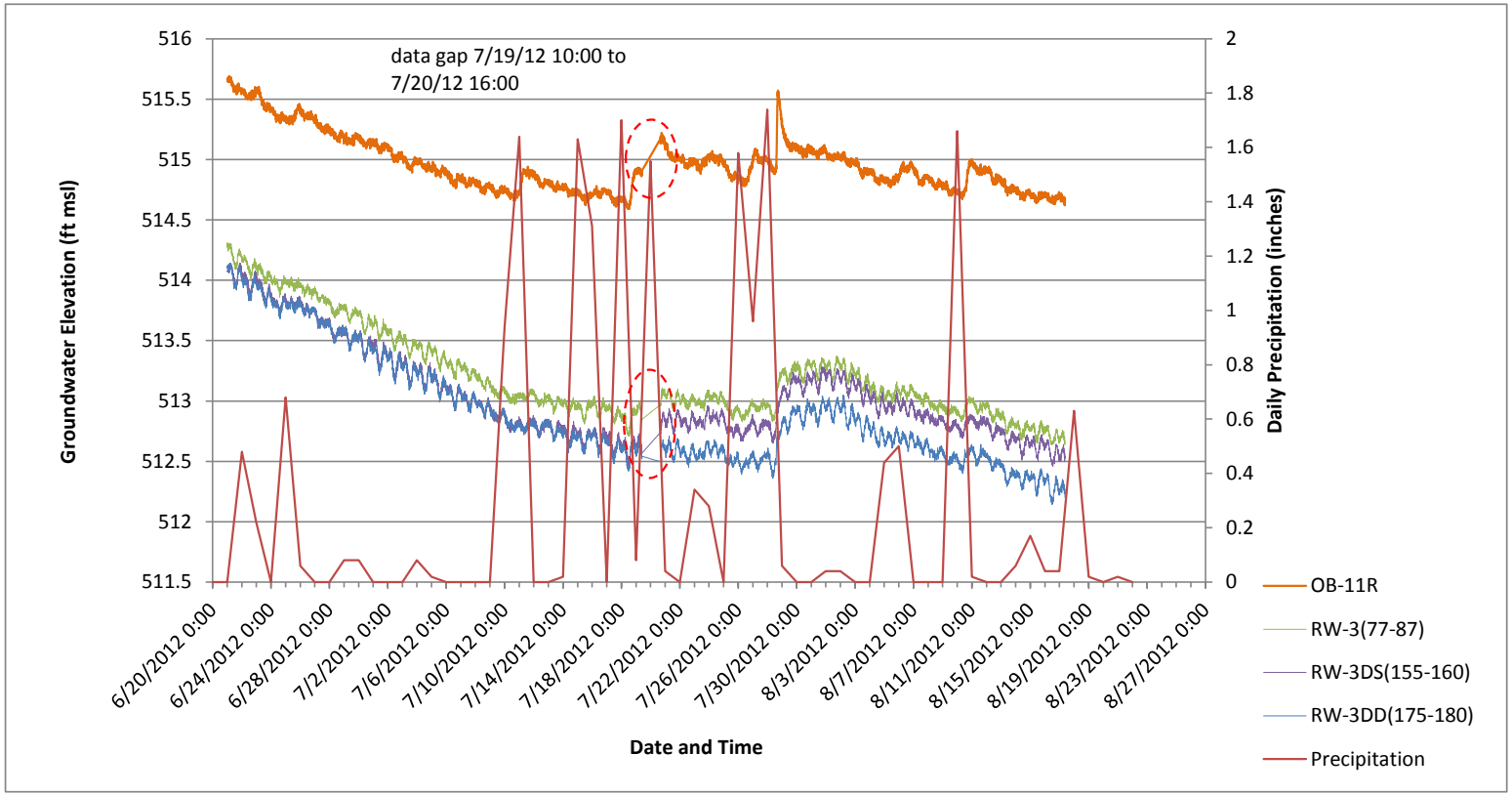
PMP: Peters Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Vertical Hydraulic Gradients, Overburden PMP Area

ARCADIS

Figure
24B



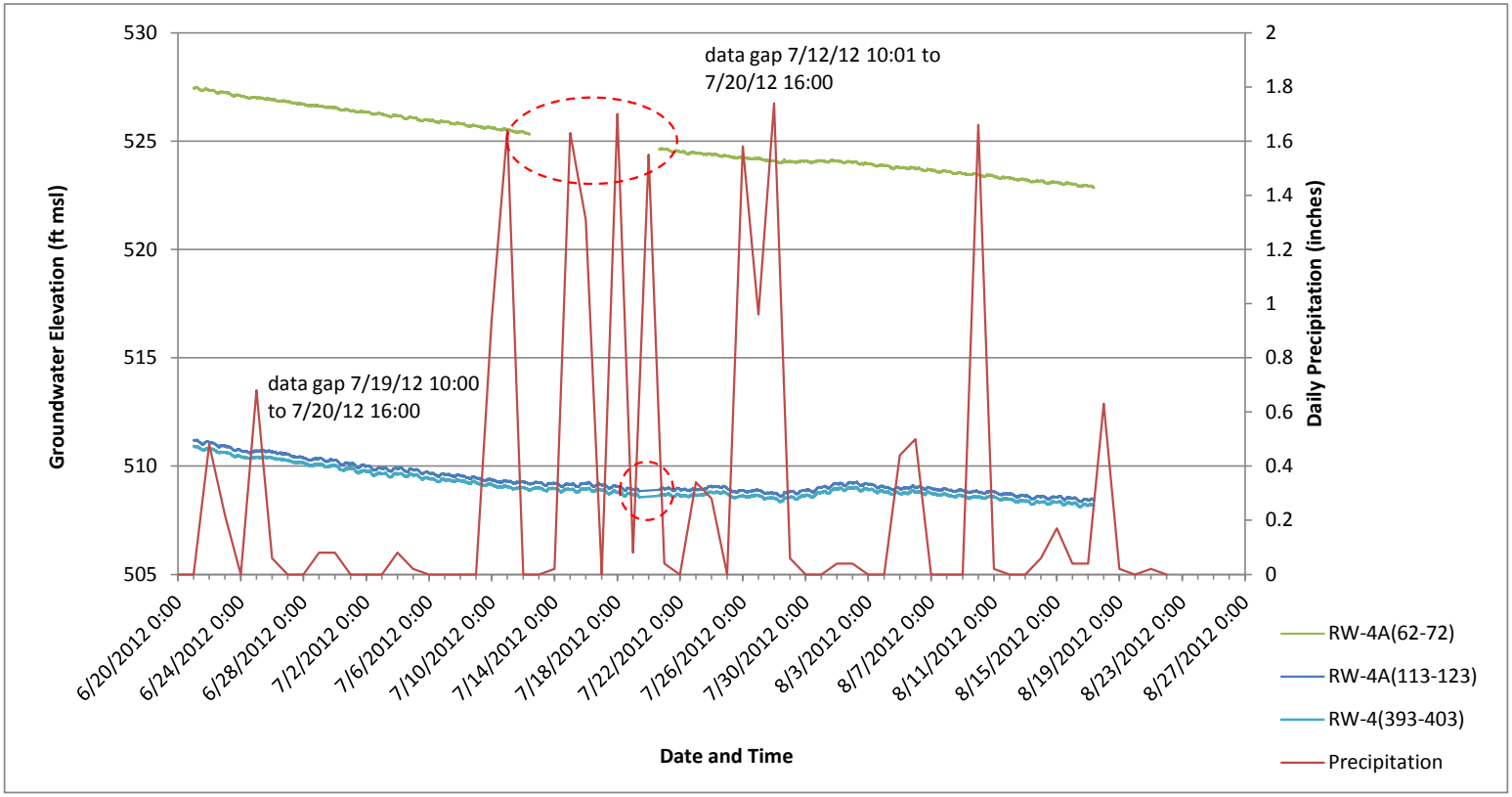
PMP: Peters Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Vertical Hydraulic Gradients, Bedrock PMP Area

ARCADIS

Figure
25A



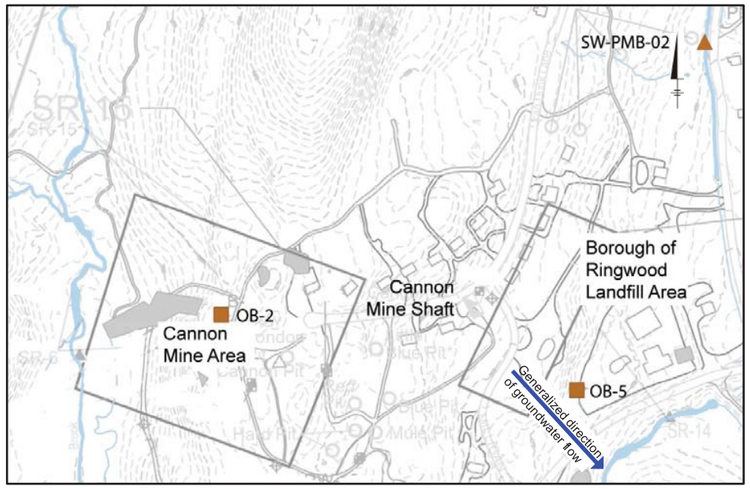
PMP: Peters Mine Pit
ft msl: feet above mean sea level

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

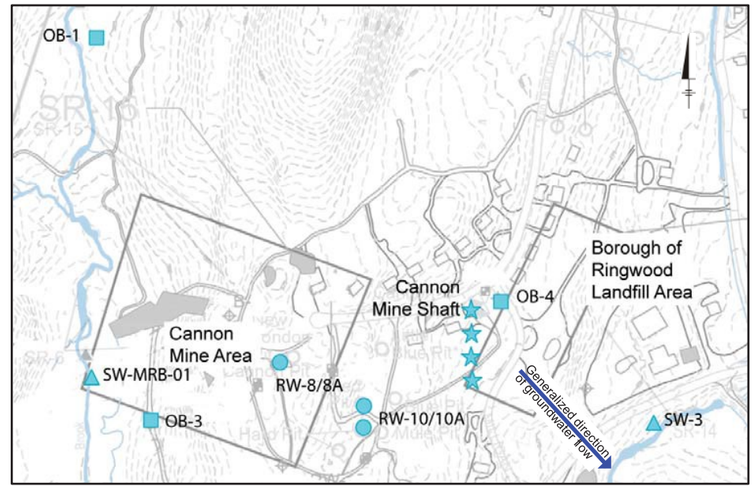
Vertical Hydraulic Gradients,
Bedrock PMP Area

ARCADIS

Figure
25B



A



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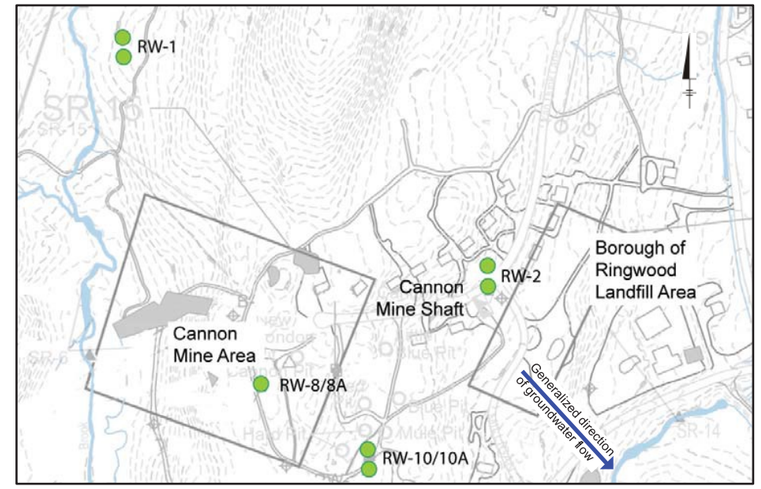

C

- Some shallow bedrock groundwater has limited influence from older deeper bedrock groundwater (**A**).
- Observed intermediate age water in pit ~~is~~ indicates a mix of modern water with older water (**B**).
- Intermediate age water may indicate connection between some shallow bedrock wells and the mine workings (**B**).
- Most shallow and deeper bedrock groundwater is older, and appears to not be connected to mine workings or pit (**C**).
- Deeper bedrock groundwater in CMP Area typically older than PMP Area indicating greater proportion of older (potentially regional) groundwater in CMP and less interaction with modern water consistent with the shallower depth of the Cannon Mine complex.

KEY:

- △ Surface Water Sample
- □ Shallow Bedrock Sample
- ○ Deeper Bedrock Sample
- ☆ Mine Shaft Sample
- 14C age <~100 years
- 14C age >100 and <1,000 years
- 14C age >~ 1,000 years
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Surface Water

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
CARBON-14 INFERRED GROUNDWATER
AND SURFACE WATER AGES (2012)

ARCADIS

FIGURE
26

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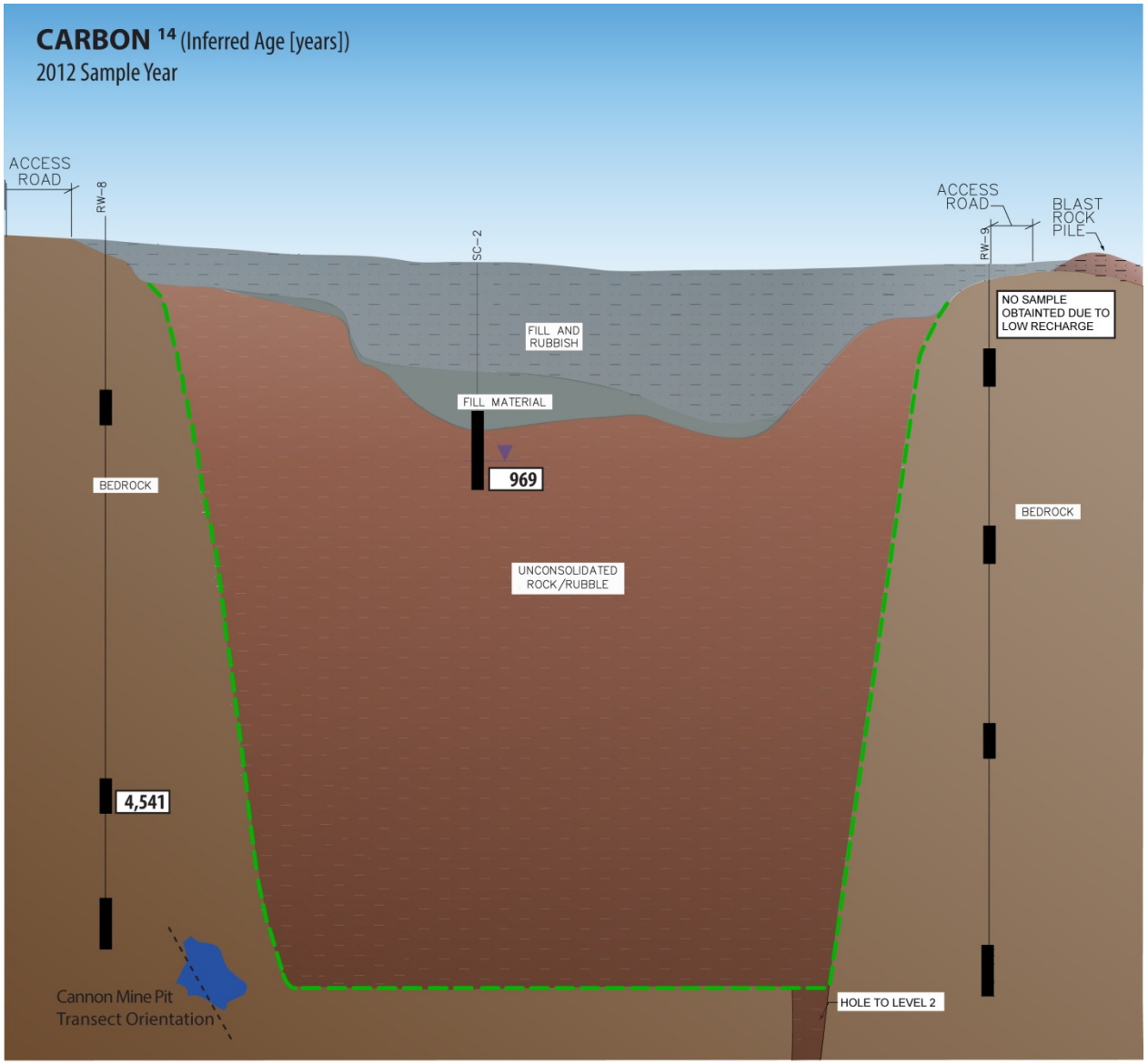


- Mix of modern and older water yields a composite or "intermediate" groundwater ages in the mine pit.
- Apparent intermediate age of Cannon Mine Pit groundwater shows less mixing of modern water (post-1953) than in the PMP.
- Bedrock groundwater at well RW-8 substantially older than the mine pit groundwater at well SC-2.

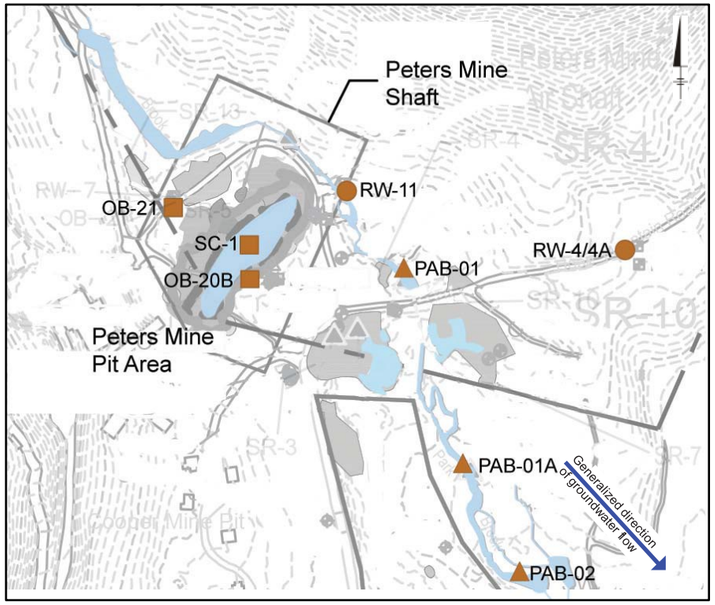
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
CARBON 14 CROSS SECTION

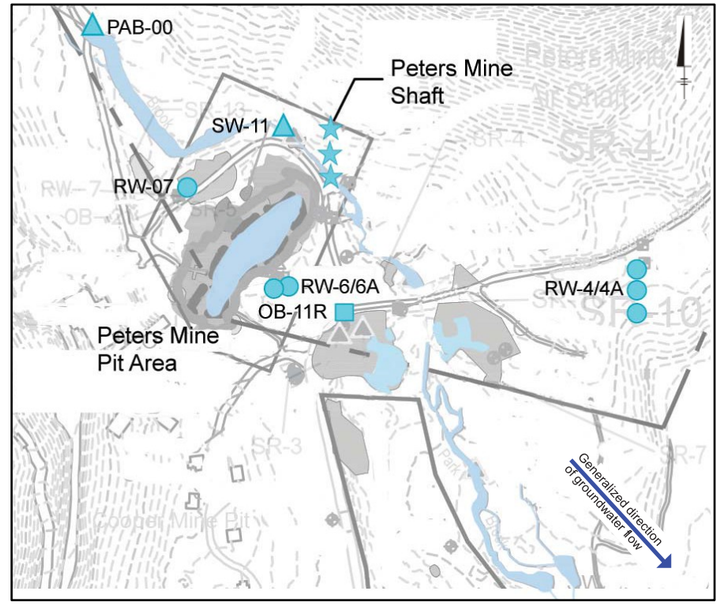
ARCADIS

FIGURE 27

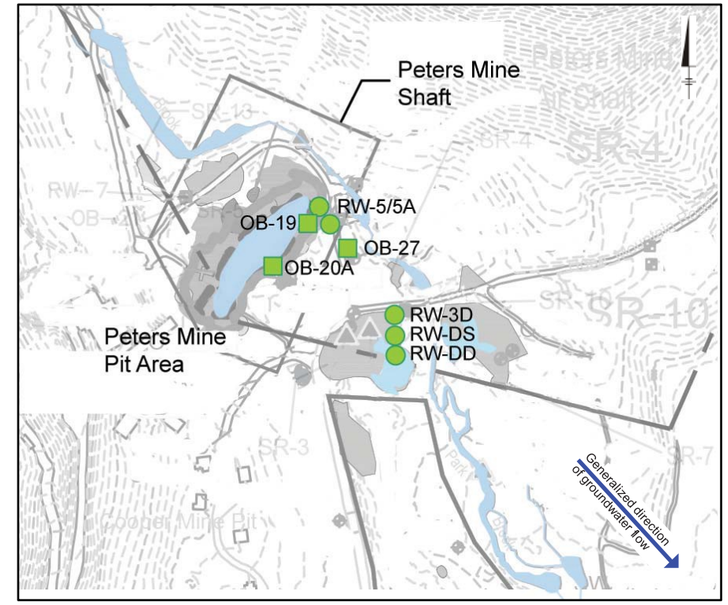
C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



A



B



C

- ^{14}C ages range from <100 years to > 1,000 years - older ages may indicate presence of regional (deeper) bedrock groundwater and mixing with more modern water.
- Youngest water is surface water, PMP water (SC-01), some overburden water, and shallow bedrock groundwater up- and down-gradient from pit. This indicates potential connectivity between pit water and nearby OB-20B and RW-6A water (**A**).
- Oldest water (overburden and bedrock) is down-gradient of PMP influence of bedrock groundwater coupled with limited interaction between PMP and most downgradient locations (**C**).
- PM Air Shaft water is intermediate age, most likely due to mixing of old water and modern water; different from neighboring sampling points. This indicates limited connection between water in the shaft and overburden and bedrock groundwater (**B**).

KEY:

- Surface Water Sample
- Overburden Sample
- Bedrock Sample
- Mine Shaft Sample
- ^{14}C age <~100 years
- ^{14}C age >100 and <1,000 years
- ^{14}C age > ~1,000 years
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Surface Water

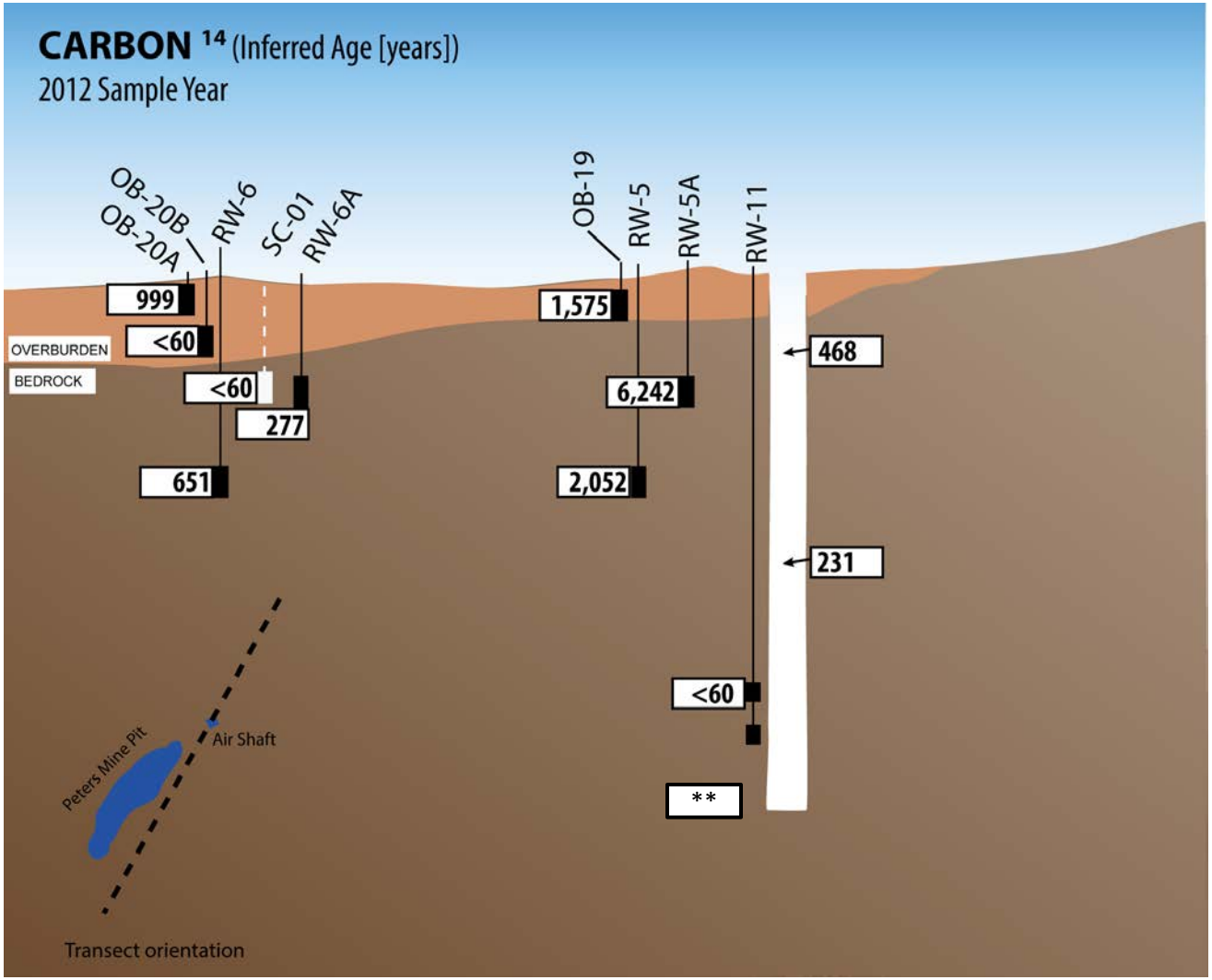
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PETERS MINE PIT
CARBON-14 INFERRED GROUNDWATER AND SURFACE WATER AGES (2012)

ARCADIS

FIGURE 28

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



- Mix of modern and older water yields a composite or "intermediate" groundwater ages in the air shaft.
- Older ages in overburden wells show old water moving from bedrock into overburden.
- Modern groundwater signature in Peters Mine Pit (SC-01) indicates a potential hydraulic connection between the PMP and well OB-20B.

** The depth of the sample collected from the base of the air shaft is suspect- the actual depth is likely to be much shallower(see report for further discussion). Therefore the data are not included in this figure.

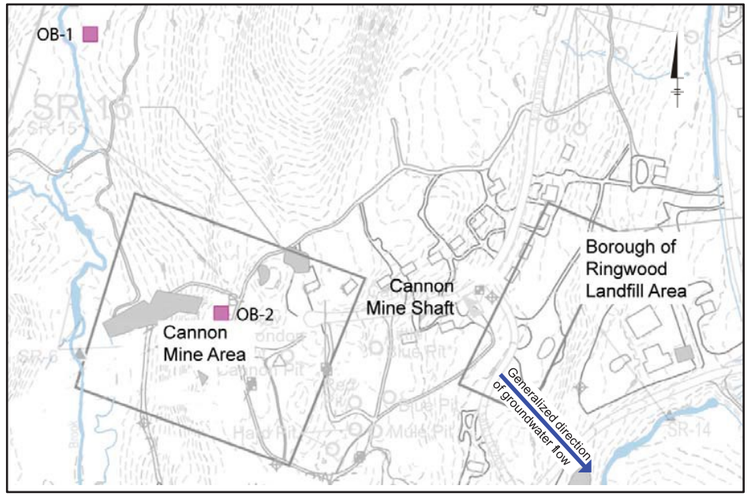
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PETERS MINE PIT
CARBON-14 CROSS SECTION

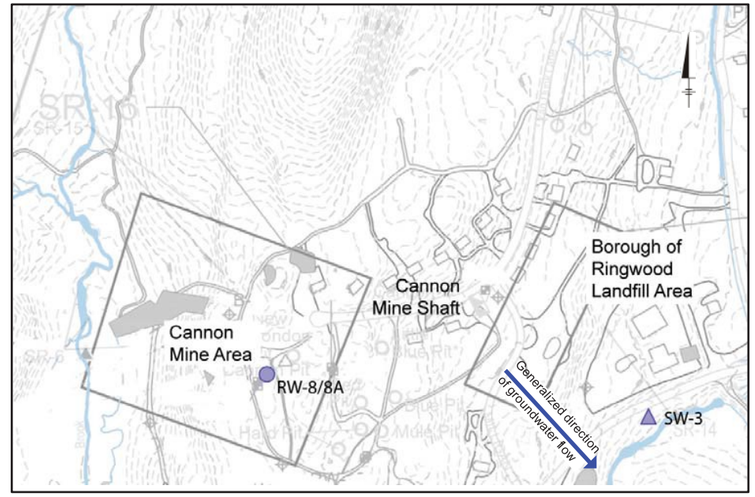
ARCADIS

FIGURE 29

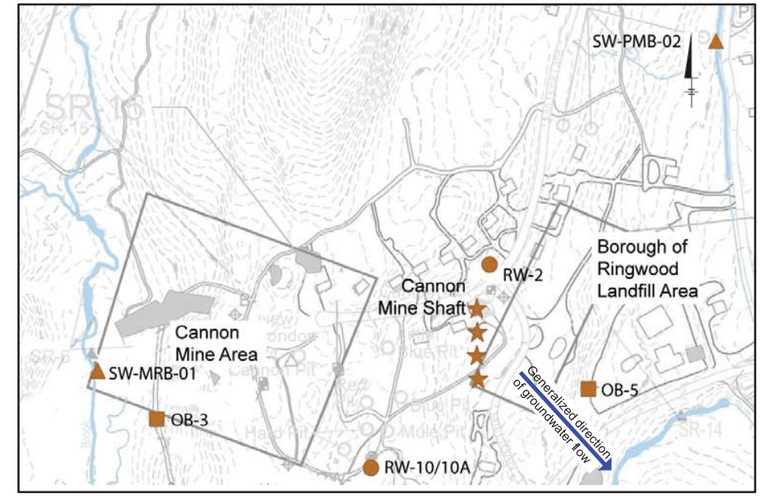
C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



A



B



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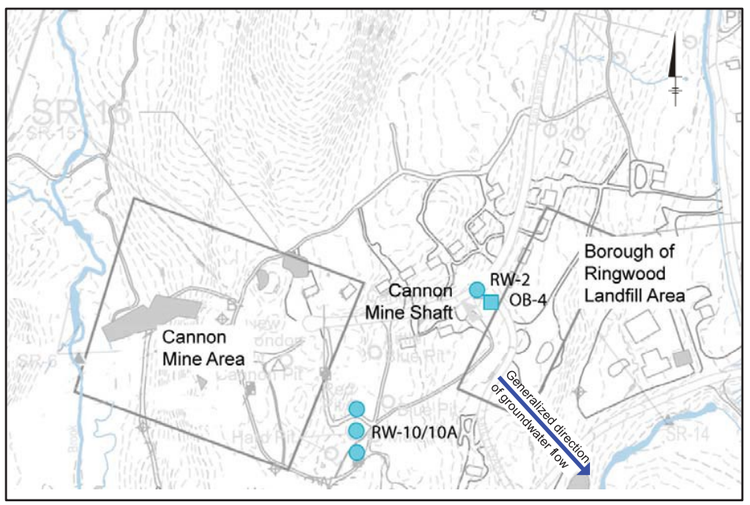
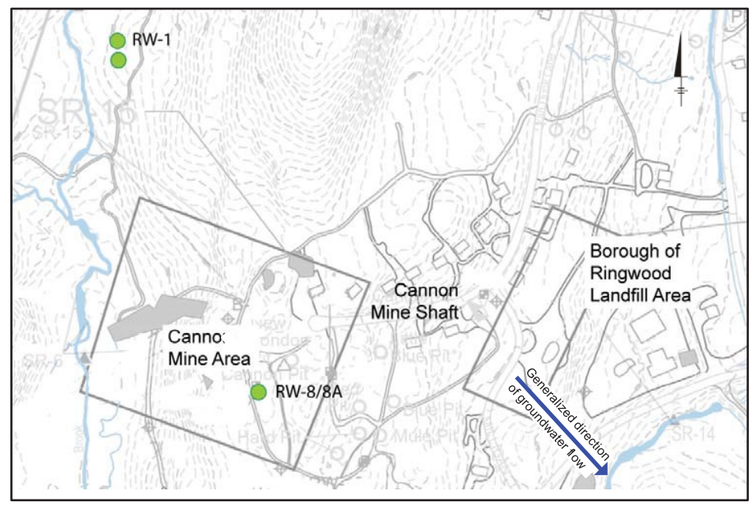


D



E

KEY:

- Surface Water Sample
- Shallow Bedrock Sample
- Deeper Bedrock Sample
- Mine Shaft Sample
- T > 8.0 TU
- T > 7 and ≤ 8
- T > 6 and ≤ 7
- T > 5 and ≤ 6
- T ≤ 5
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Surface Water

- Tritium (T) detected at all locations – some fraction of modern (post 1952) water present at all locations.
- Highest tritium in three bedrock locations, the pit and one surface water sample indicates greater proportion of water from "Bomb Pulse" (ca 1955 to 1965) (**A & B**).
- Dilution with tritium-free water (older than 60 years) may underestimate contribution of modern water (post – 1950s).
- Mixing of modern and older water probably accounts for intermediate concentrations of tritium in the shaft water.
- Similar ages in nearby wells reveal possible connection of wells with mine workings (**C and D**).
- Lesser influence of modern water in some deep bedrock groundwater suggests less mixing (**E**).

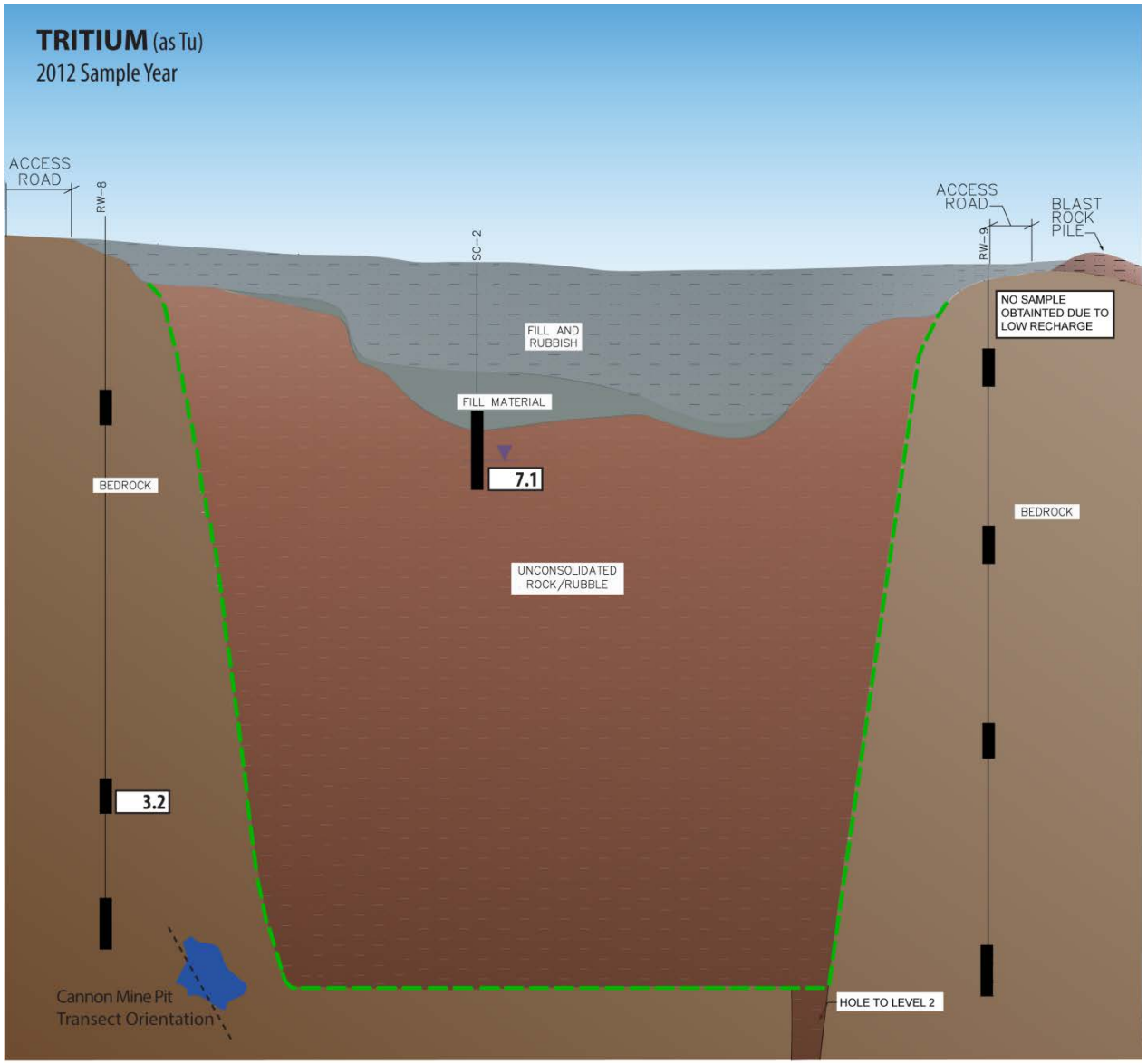
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
TRITIUM CONCENTRATIONS IN
GROUNDWATER AND SURFACE WATER (2012)

ARCADIS

FIGURE
30

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



- Tritium detected in both the Cannon Mine Pit and RW-8 (deeper bedrock groundwater) indicating contributions of modern water (post 1953).
- Lower tritium concentration in RW-8 (deeper bedrock) groundwater suggests limited hydraulic connectivity with the shallow mine pit groundwater.

Ringwood Mines/Landfill Site
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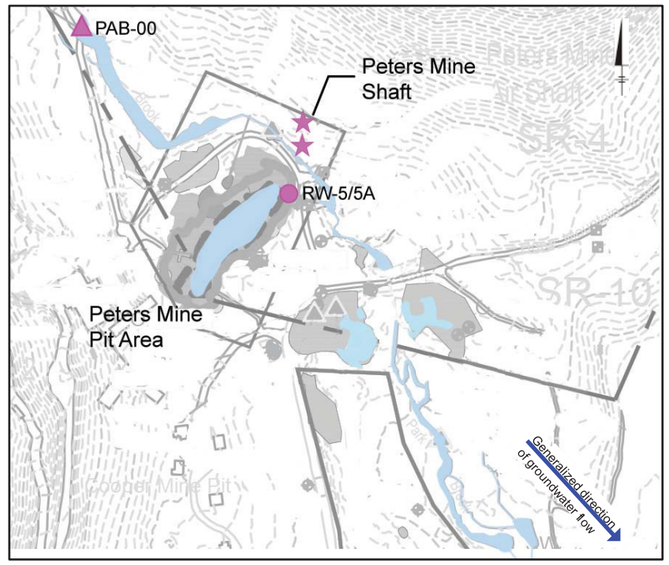
CANNON MINE PIT
TRITIUM CROSS SECTION

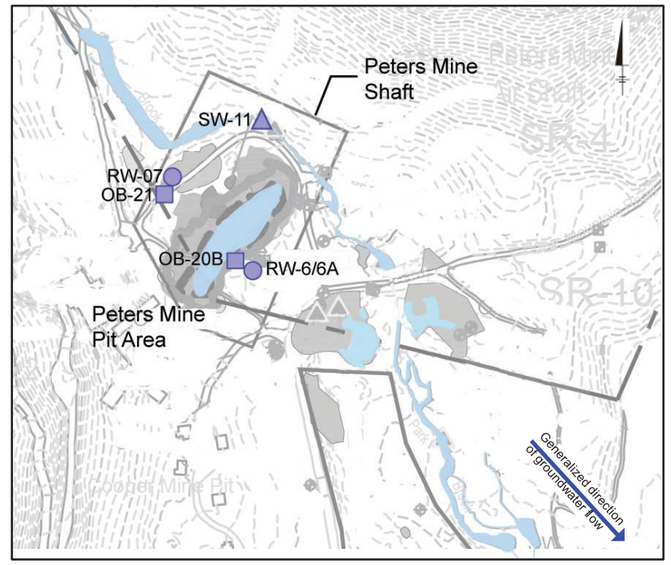
ARCADIS

FIGURE 31

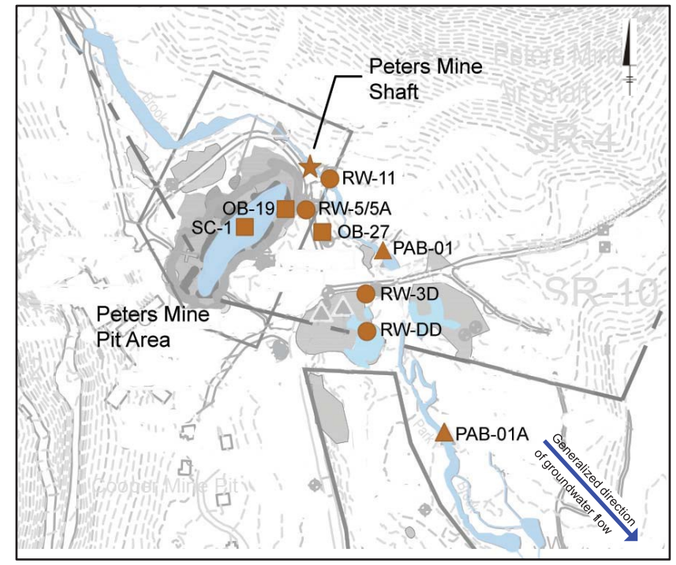
C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



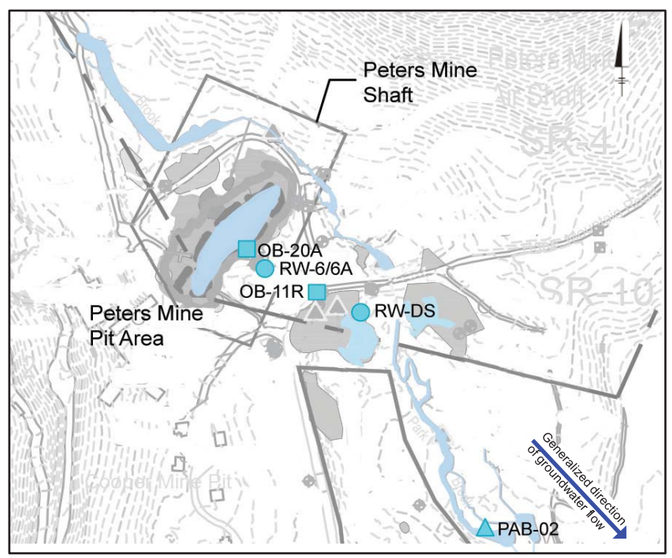
A



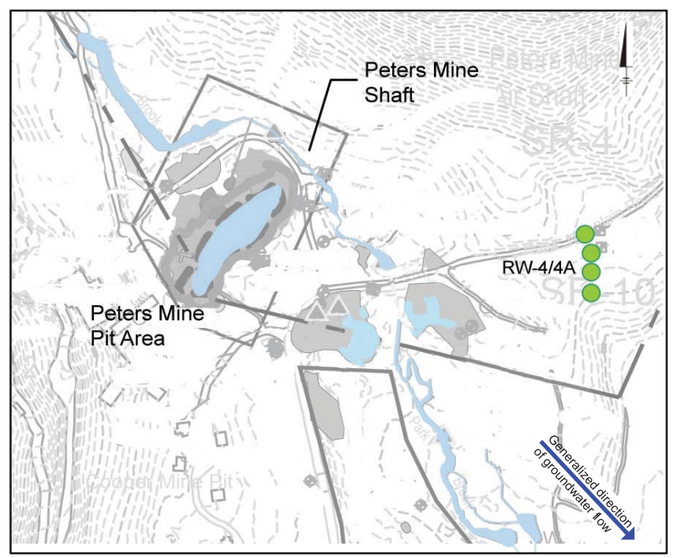
B



C



D



E

KEY:

- Surface Water Sample
- Overburden Sample
- Bedrock Sample
- Mine Shaft Sample
- T > 8.0 TU
- T > 7 and ≤ 8
- T > 6 and ≤ 7
- T > 5 and ≤ 6
- T > 4 and ≤ 5
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Surface Water

- Tritium detected at all locations indicating that some fraction of "modern" (post 1952) water is present at all locations.
- Highest T in PM air shaft, up-gradient surface water, and intermediate depth bedrock water at RW-5 may indicate greater influx of modern precipitation (i.e., greater proportion of water from "bomb pulse" -ca 1955 to 1965) (**A & B**).
- Lowest T at wells RW-4 and RW-4A down-gradient of mine shows least influence of modern water (**E**).
- T in surface water decreases from upstream of the pit to downstream of the pit. This may indicate increased discharge of older groundwater along stream channel (**A, C & D**).
- Dilution with tritium-free water (older than 60 years) may underestimate contribution of modern water.

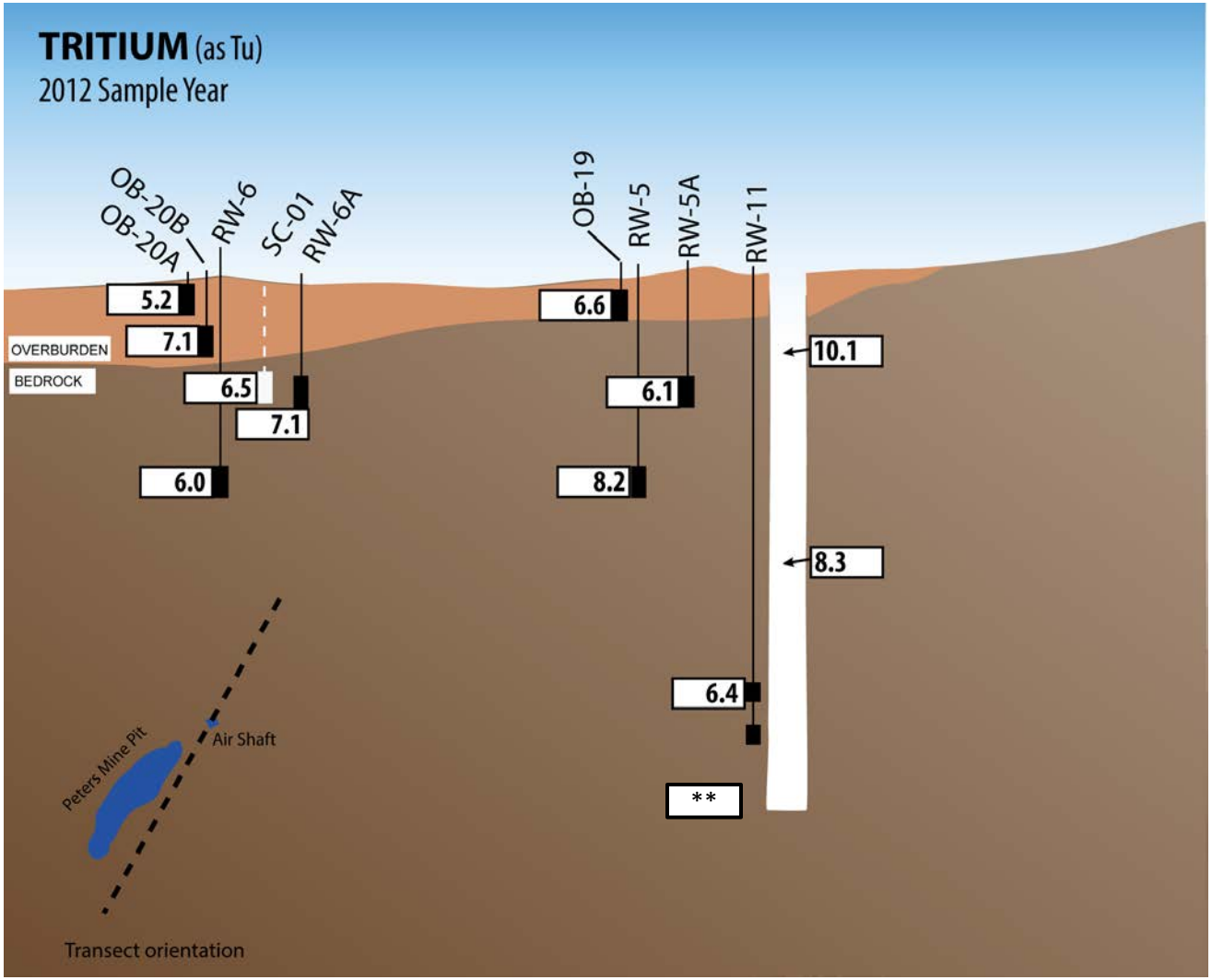
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PETERS MINE PIT
TRITIUM CONCENTRATIONS IN GROUNDWATER AND SURFACE WATER (2012)

ARCADIS

FIGURE 32

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



- Presence of tritium in all wells indicates a contribution of modern water (post 1953).
- Higher tritium concentrations in the air shaft may indicate an influx of modern precipitation.
- Intermediate tritium concentrations in SC-01 (mine pit) may be indicative of a contribution from shallow bedrock groundwater.

** The depth of the sample collected from the base of the air shaft is suspect- the actual depth is likely to be much shallower(see report for further discussion). Therefore the data are not included in this figure.

Ringwood Mines/Landfill Site
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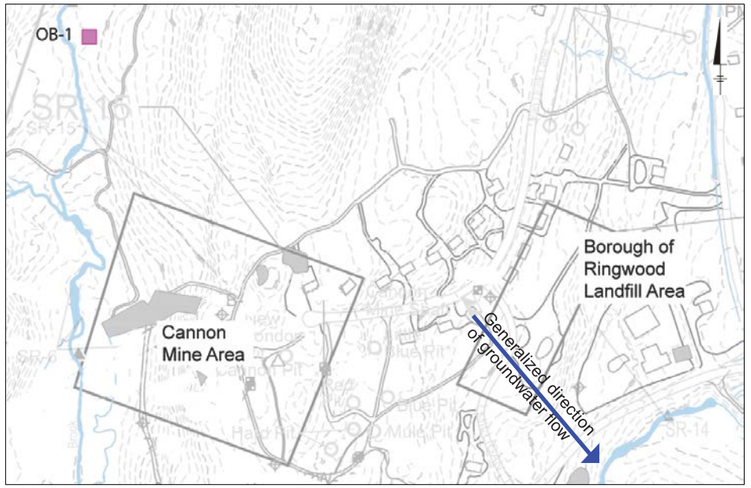
PETERS MINE PIT
TRITIUM CROSS SECTION

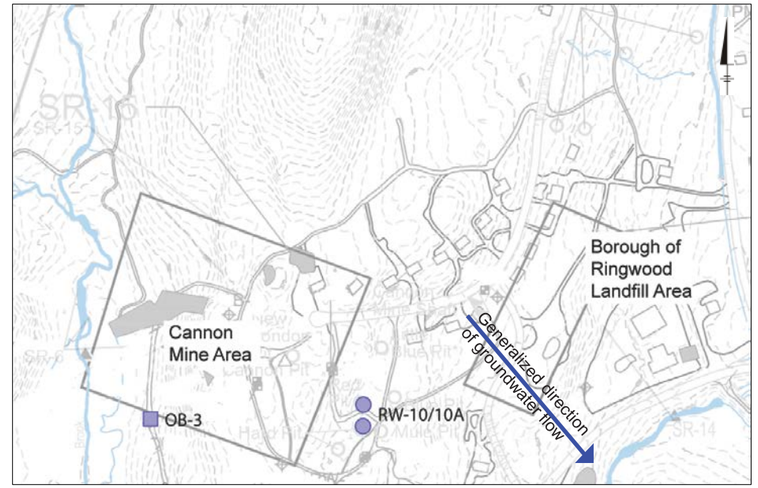
ARCADIS

FIGURE 33

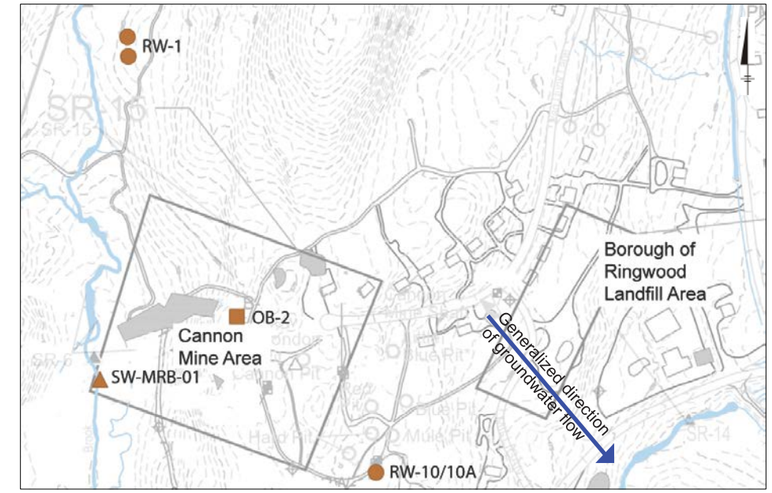
C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



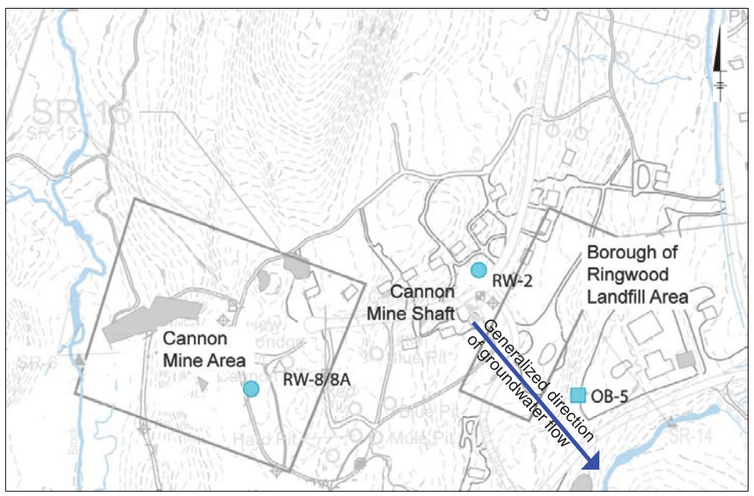
A



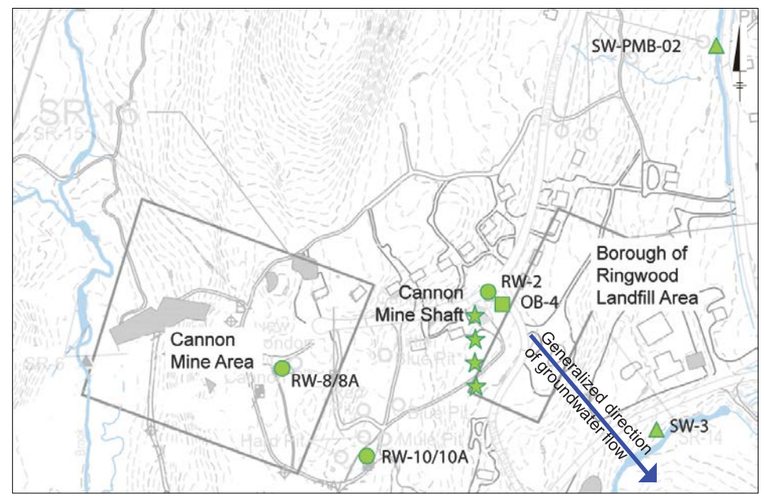
B



C



D



E

KEY:

- Surface Water Sample
- Shallow Bedrock Sample
- Deeper Bedrock Sample
- Mine Shaft Sample
- >1,000 pCi/L
- > 500 and ≤ 1,000
- > 100 and ≤ 500
- > ND and ≤ 100
- Not Detected
- Paint Sludge Removal (SR) and Targeted Removal Areas

- Radon (^{222}Rn) concentrations are found in the presence of naturally occurring ^{238}U-containing minerals in bedrock and overburden, and can identify short range hydraulic connections .
- Radon detected in surface water sample indicates discharge of groundwater in the vicinity of this location (**C**).
- Radon is not detected in CM shaft indicating limited contact with ^{238}U-containing minerals, no hydraulic connection to other radon source areas, or a stagnant zone where rapid decay of ^{222}Rn results in concentration below non-detect (**E**).
- Radon generally higher in shallow bedrock. There may be higher fracture density in shallow bedrock exposing more ^{238}U and ^{226}Ra to support observed ^{222}Rn.
- Radon analysis helps confirm discharge of groundwater to Mine Brook.

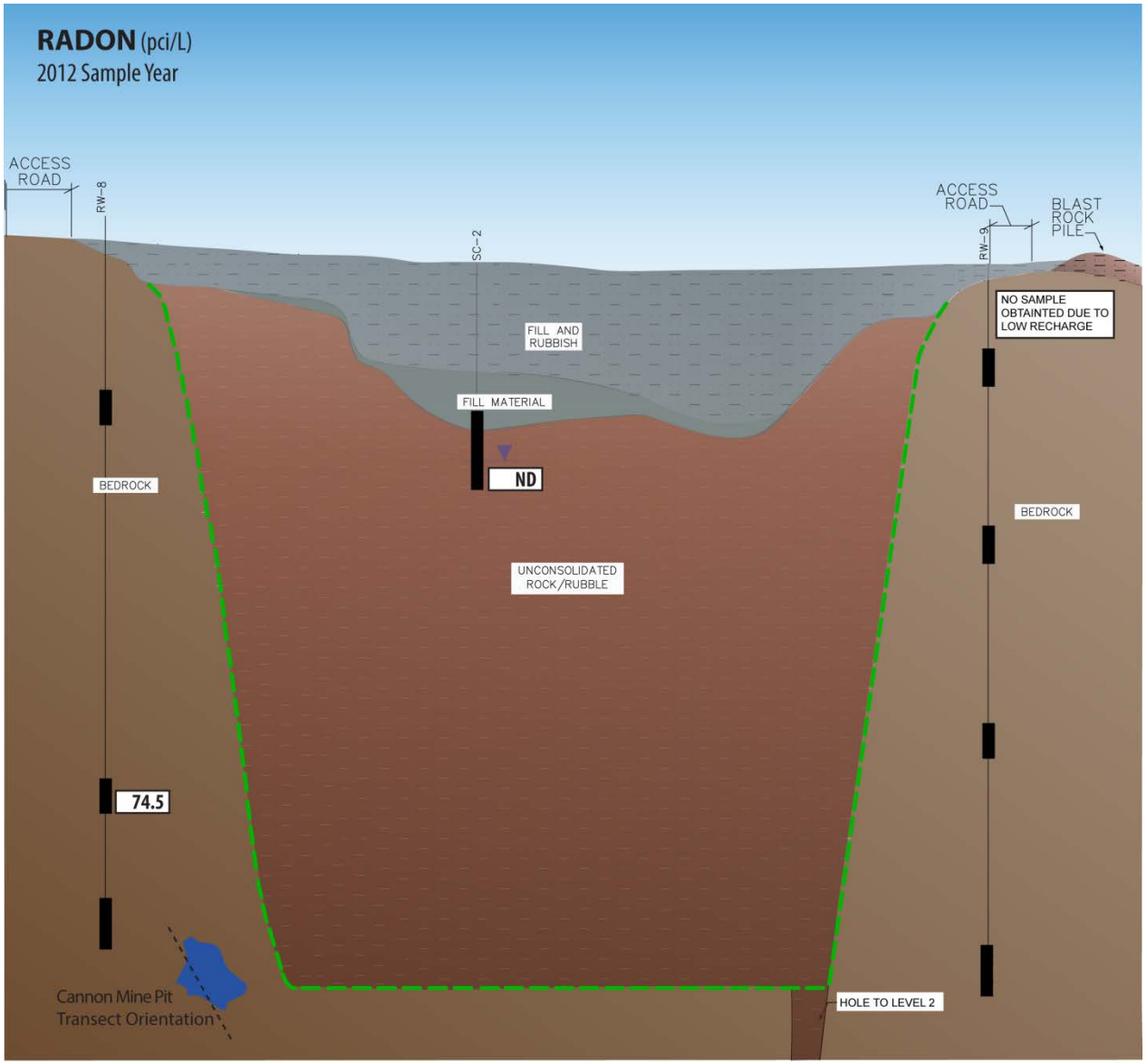
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
RADON CONCENTRATIONS IN GROUNDWATER AND SURFACE WATER (2012)

ARCADIS

FIGURE 34

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



- Absence of radon in the shallow Cannon Mine Pit groundwater, but presence in RW-8 indicates very limited interaction with bedrock groundwater and/or dilution of shallow mine pit groundwater by recharge from precipitation.

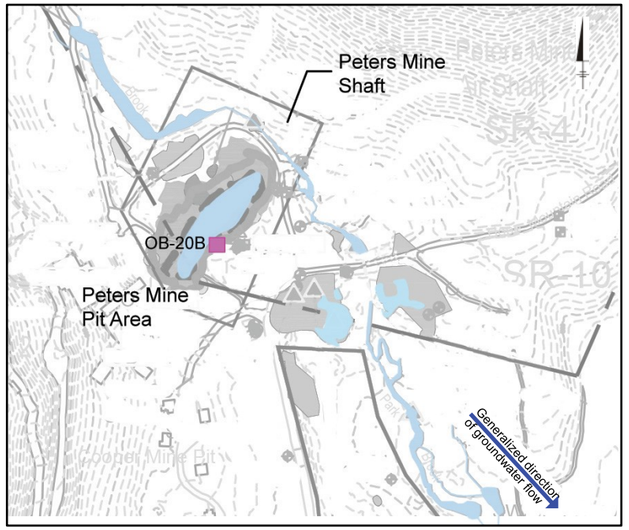
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
RADON CROSS SECTION

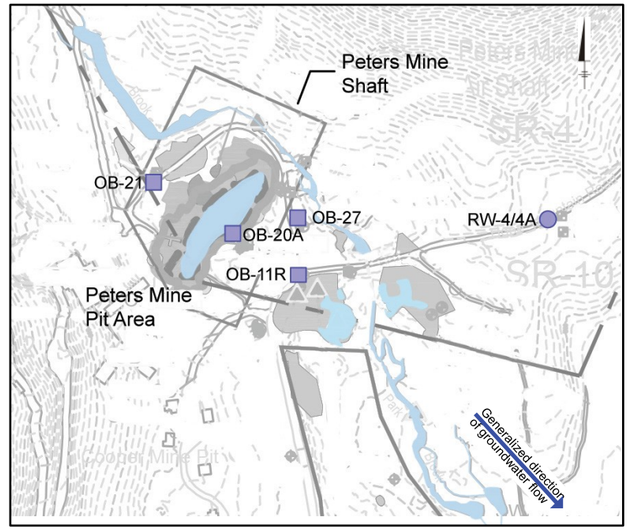
ARCADIS

FIGURE 35

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



A



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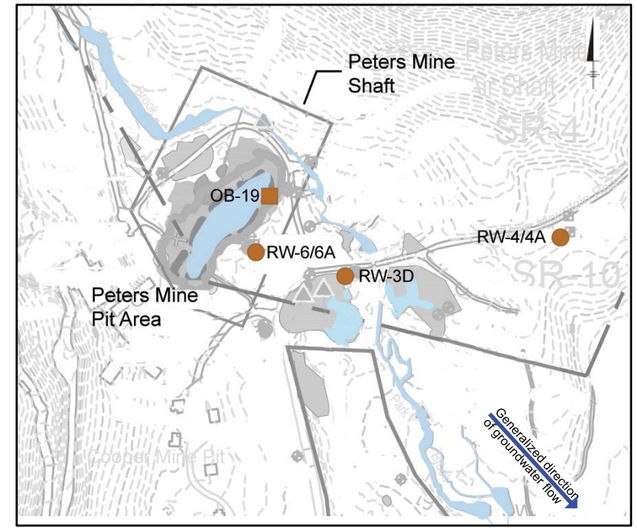

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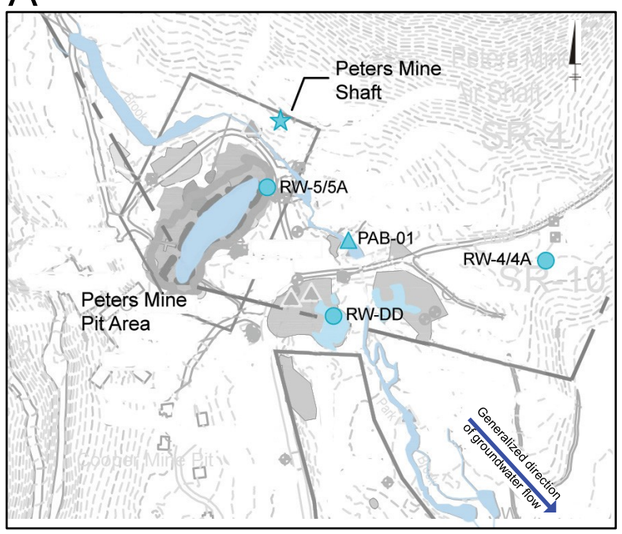

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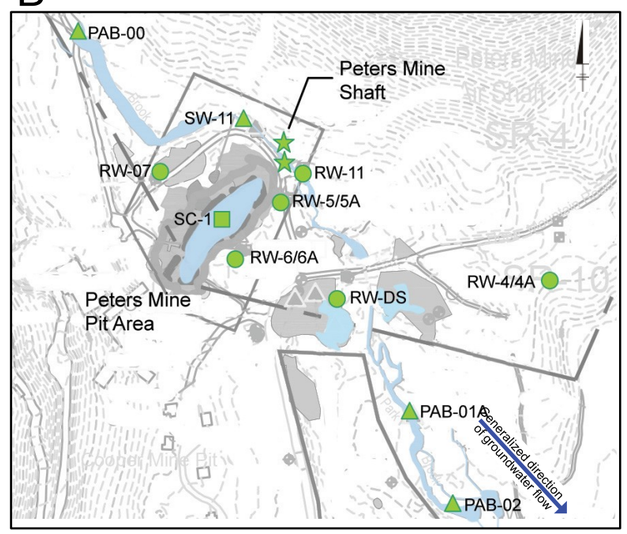

E

KEY

- Surface Water Sample
- Overburden Sample
- Bedrock Sample
- Mine Shaft Sample
- >1,000 pCi/L
- > 500 and ≤ 1,000
- > 100 and ≤ 500
- > ND and ≤ 100
- Not Detected
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Surface Water

- Radon (^{222}Rn) concentrations are found in the presence of naturally occurring ^{238}U-containing minerals in bedrock and overburden, and can identify short range hydraulic connections
- Radon generally higher in overburden and shallow bedrock. There may be higher fracture density in shallow bedrock exposing more ^{238}U and ^{226}Ra to support observed ^{222}Rn, or water in the shaft, pit or mine working is essentially stagnant, so that the rapid decay of ^{222}Rn results in concentration below non-detect in the deeper rock and mine workings.
- Highest radon activity in well OB-20B downgradient from PMP. Elevated activity found in most overburden wells indicates recharge of shallow bedrock groundwater to overburden at these locations (**A**)
- Radon is not detected in pit water (SC-01), which is consistent with primary influence of precipitation recharge (and not bedrock groundwater) (**E**)
- Radon detected in one surface water sample in middle of PMP Area is consistent with other data that indicate discharge of groundwater to surface water in this area (**D**)
- Low or non-detect ^{222}Rn activity in PM air shaft indicates possible limited contact with ^{238}U-containing minerals or a stagnant water zone that allows decay of the ^{222}Rn. It also suggests that there is no hydraulic connection to the shallow bedrock where highest Radon activity is observed (**E**)

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Ringwood, New Jersey
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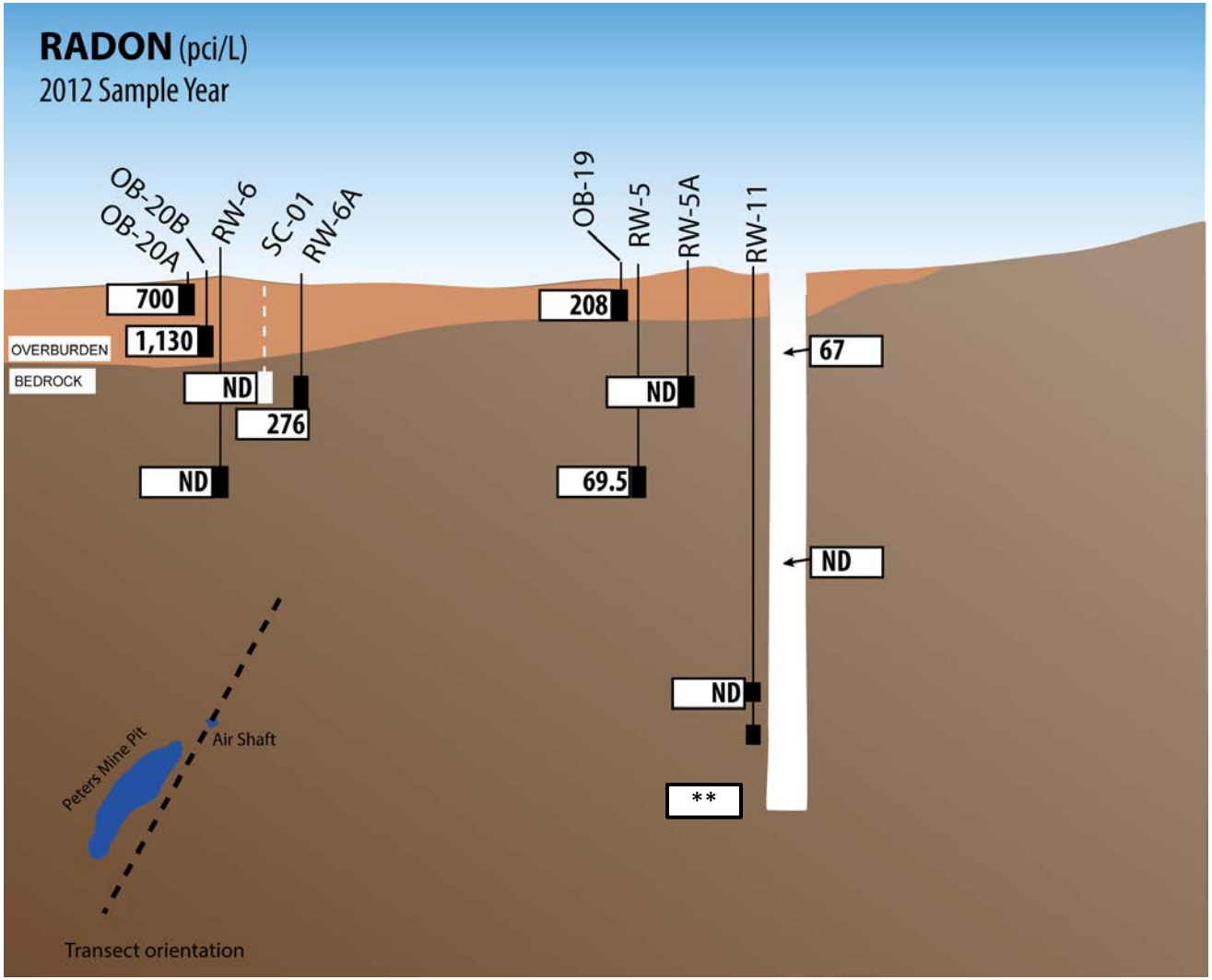
PETERS MINE PIT
RADON CONCENTRATIONS IN GROUNDWATER AND SURFACE WATER (2012)

ARCADIS

FIGURE 36

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



- Radon concentrations >300 pCi/L are generally limited to the upper 100 feet of overburden and bedrock groundwater consistent with greater rock surface exposure in the higher density fracturing present at shallow bedrock depths.
- Limited detections of radon in the PM Air Shaft groundwater indicates limited connectivity between the air shaft, shallow bedrock and overburden groundwater.

** The depth of the sample collected from the base of the air shaft is suspect- the actual depth is likely to be much shallower(see report for further discussion). Therefore the data are not included in this figure.

Ringwood Mines/Landfill Site
Ringwood, New Jersey
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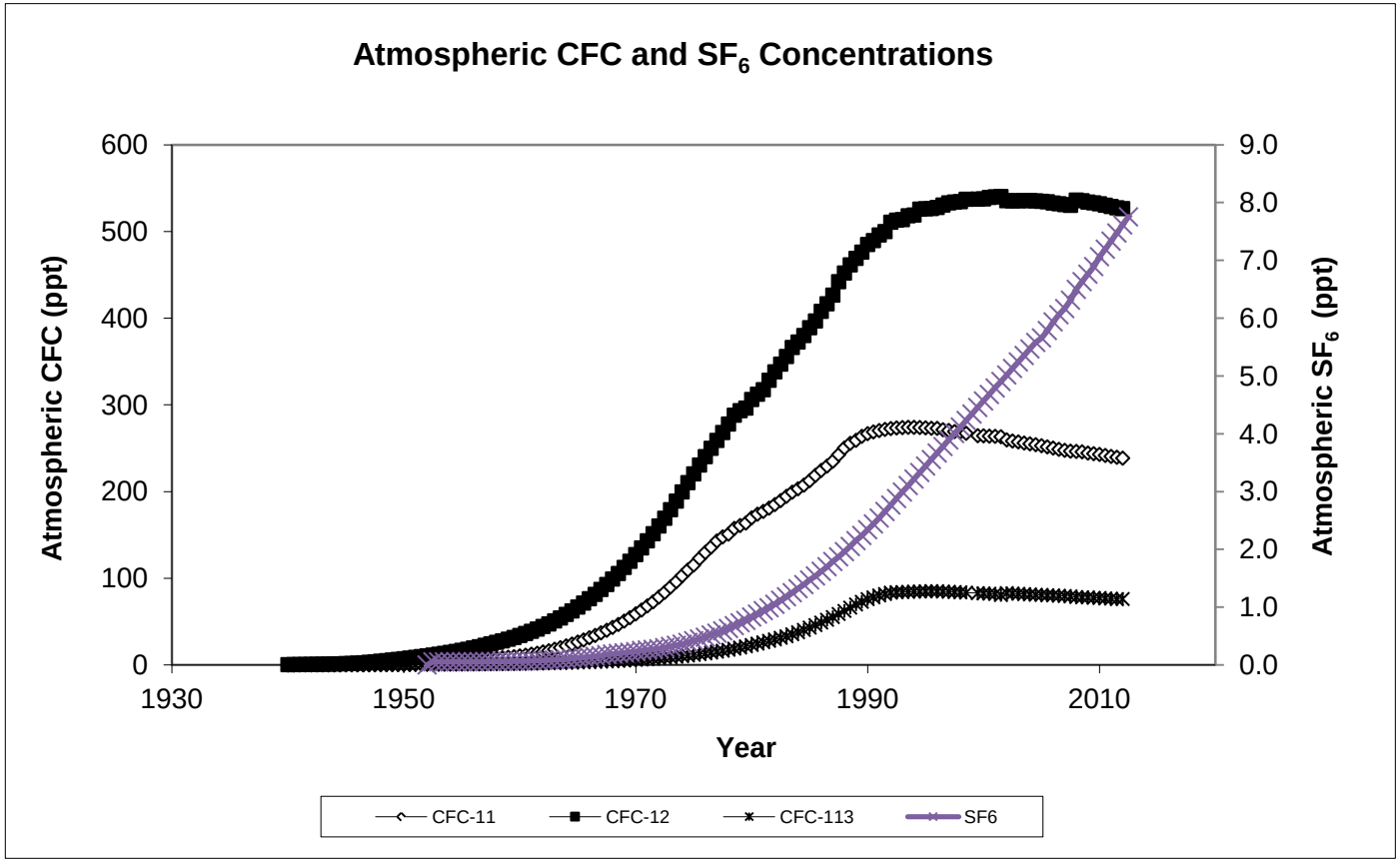
PETERS MINE PIT
RADON CROSS SECTION

ARCADIS

FIGURE 37

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



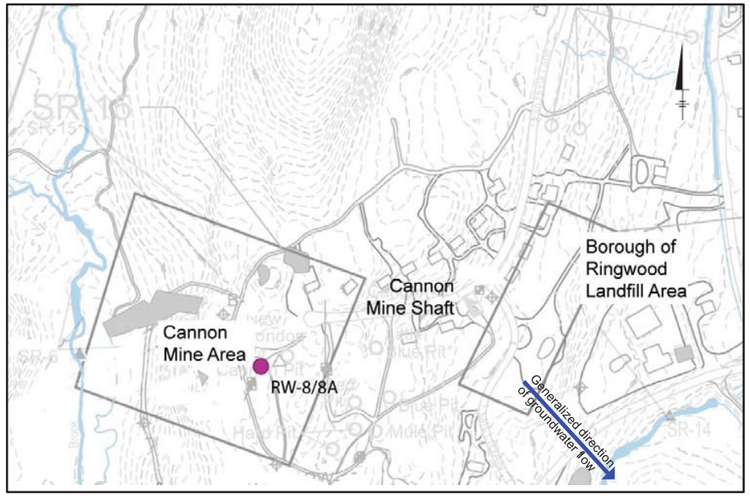
Source: University of Utah Laboratory
CFC: chlorofluorocarbon
SF_6: sulfur hexafluoride
ppt: parts per thousand

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Atmospheric CFC and SF_6 Concentrations

ARCADIS

Figure
38



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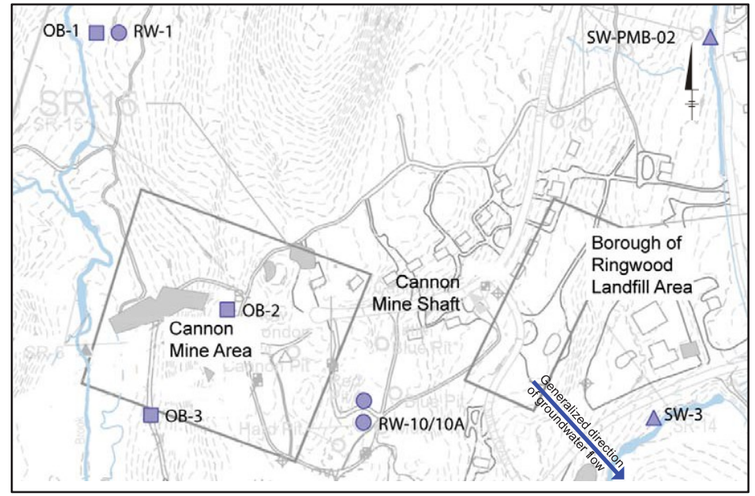

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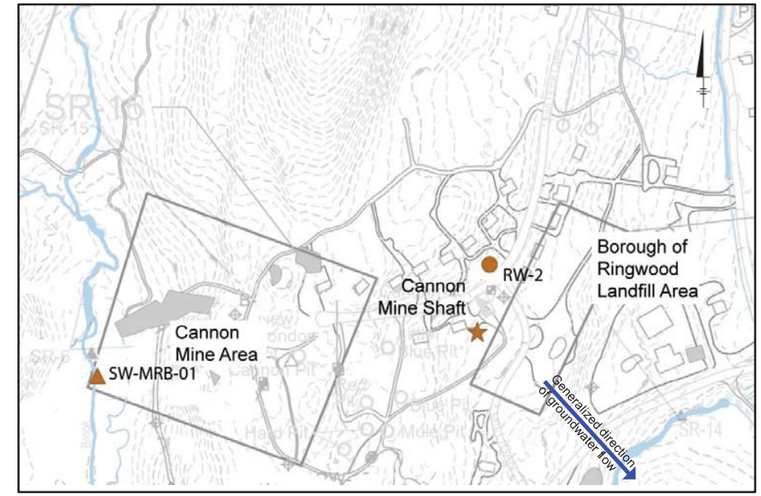
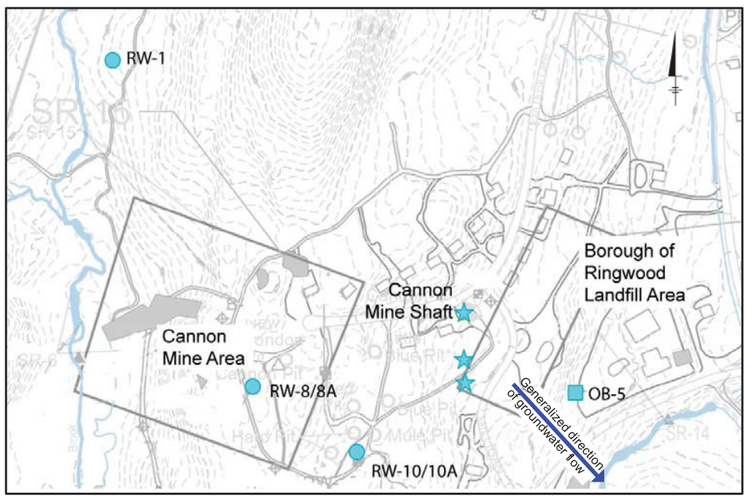


C



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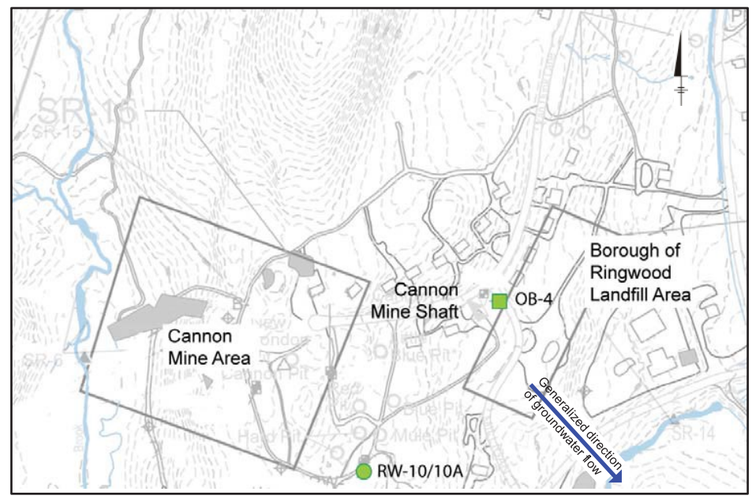


E

KEY:

- Surface Water Sample
- Shallow Bedrock Sample
- Deeper Bedrock Sample
- Mine Shaft Sample
- Out of Range
- 1990s
- 1980s
- 1970s
- 1960s
- 1950s
- Paint Sludge Removal(SR) and Targeted Removal Areas
- Surface Water

- CFCs detected in all samples indicating presence of some portion of modern water (post 1940) at all locations.
- Location of site near regional urban centers and possible CFCs present in disposed material may result in overestimate of recharge date (water may be somewhat older than) inferred from CFC concentrations– CFC12 out of range for most samples, and CFC11 and CFC113 out of range for some samples indicating local CFC source(s).
- CFC concentrations suggest a hydraulic connection between some of the groundwater monitoring locations.
- OB-4 groundwater is not hydraulically connected or only minimally connected with groundwater in the CM shaft.
- CFC analysis has limited utility for connectivity analysis in the CMP.

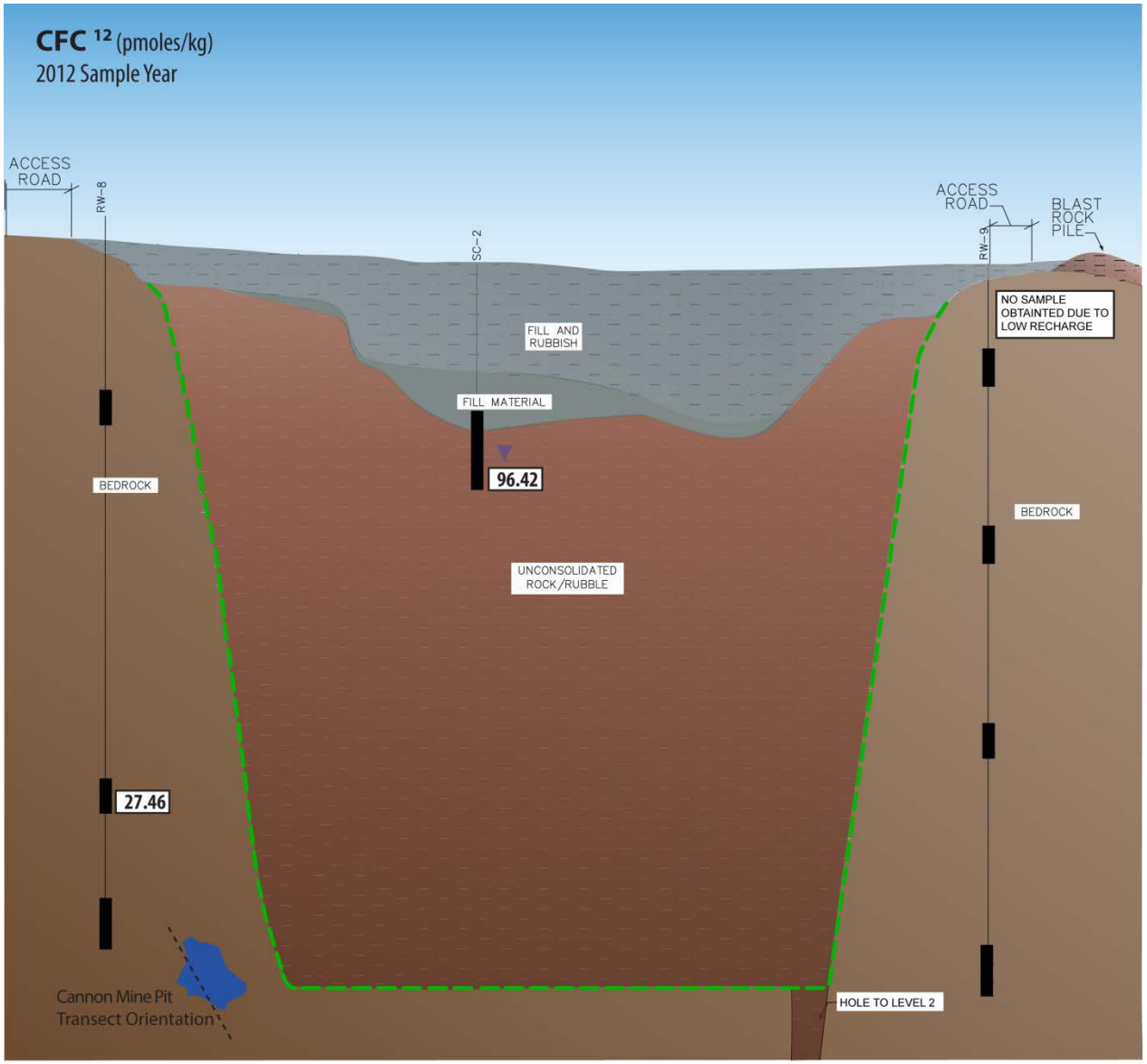
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
CFC INFERRED GROUNDWATER AND SURFACE WATER RECHARGE YEAR (2012)

ARCADIS

FIGURE 39

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



- Detections of CFC-12 in both the Cannon Mine Pit and deeper bedrock groundwater observed.
- Elevated CFC-12 concentrations can be related to degradation of styrofoam and/or aerosols in the mine pit. Non-atmospheric CFC-12 contributions can make groundwater appear younger than its actual age.
- Measured CFC-12 concentrations higher that maximum historical CFC-12 concentration in atmosphere.
- CFC-12 concentrations suggest a hydraulic connection between some groundwater monitoring locations.
- CFC analysis to evaluate connectivity for CMP is therefore inconclusive.

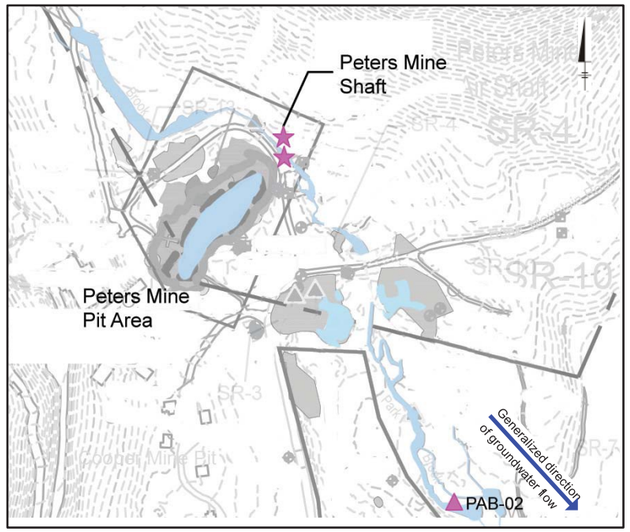
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CANNON MINE PIT
CFC 12 CROSS SECTION

ARCADIS

FIGURE 40

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



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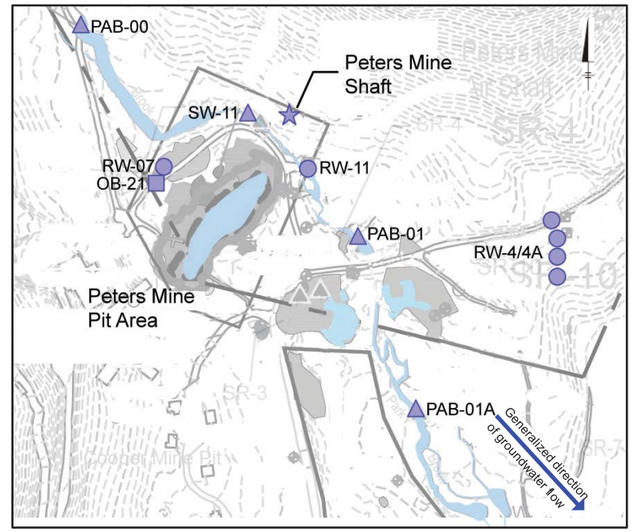

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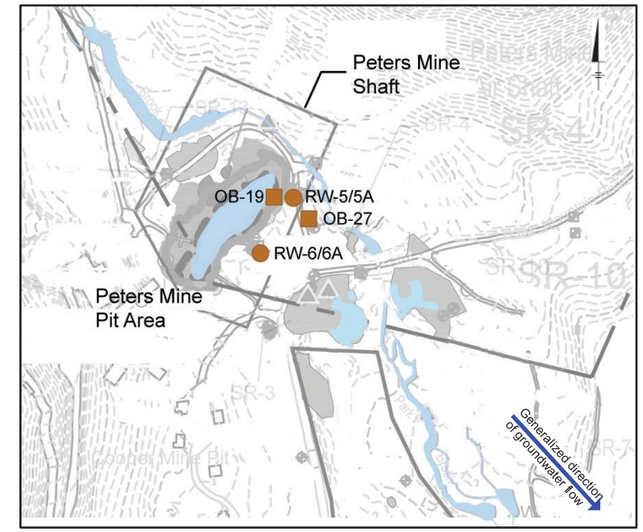
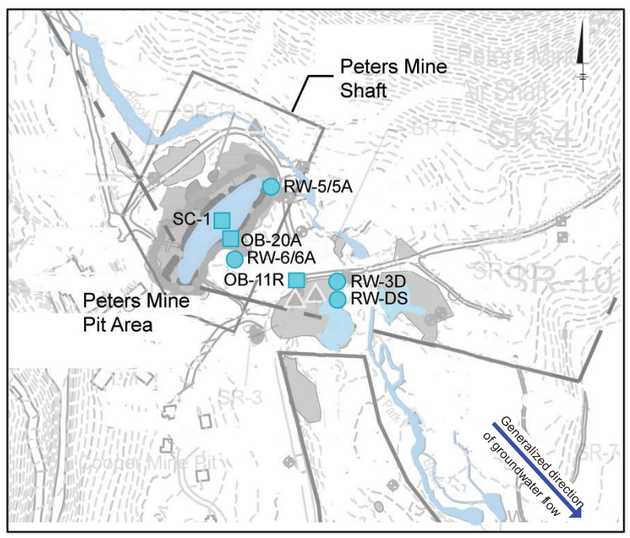


C



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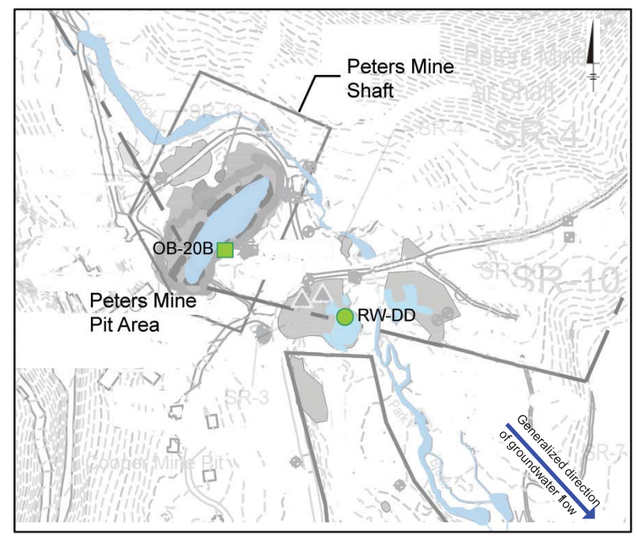

E

KEY:

- Surface Water Sample
- Overburden Sample
- Bedrock Sample
- Mine Shaft Sample
- 1990s
- 1980s
- 1970s
- 1960s
- 1950s
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Surface Water

- CFCs detected in all samples indicating presence of some portion of "modern" water (post 1940) at all locations.
- Location of site near regional urban centers and possible CFCs present in disposed material may result in overestimate of recharge date (water may be older than inferred from CFC concentration) – CFC12 is out of range for most samples indicating local CFC source(s).
- CFC concentrations suggest a hydraulic connection between some of the groundwater monitoring locations.
- CFC analysis has limited utility for assessing connectivity of groundwater in the PMP.

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PETERS MINE PIT
CFC INFERRED GROUNDWATER AND SURFACE WATER RECHARGE YEAR (2012)

ARCADIS

FIGURE 41

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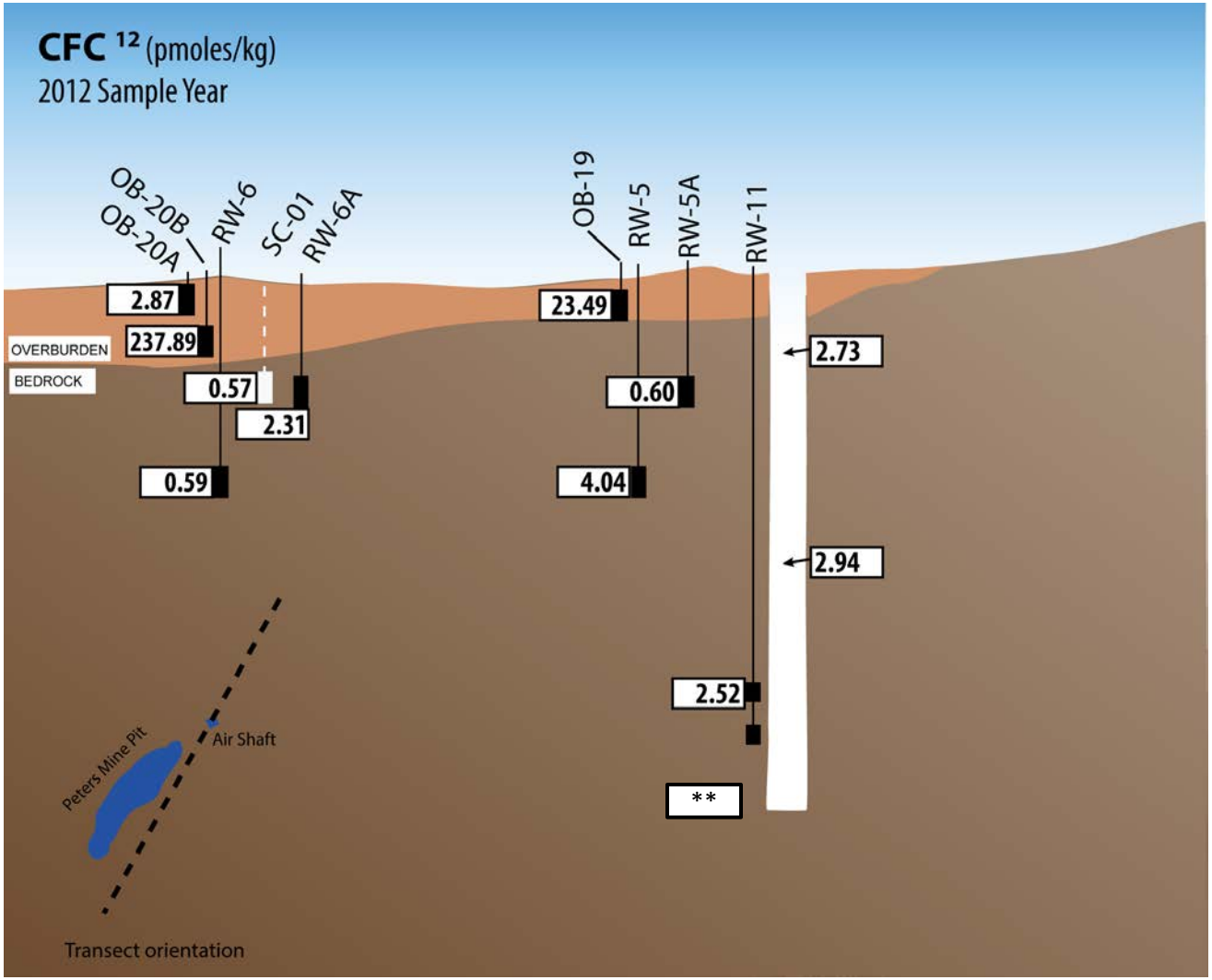

- Detections of CFC-12 in all groundwater samples.
- Elevated CFC-12 concentrations can be related to degradation of styrofoam and/or aerosol release in the mine pit. This non-atmospheric CFC contribution can make groundwater appear younger than its actual age.
- Some measured CFC-12 concentrations (> 2.9) higher than maximum historical CFC-12 concentration in atmosphere.
- CFC concentrations suggest a hydraulic connection between some groundwater monitoring locations.
- CFC analysis to evaluate connectivity for PMP is inconclusive.

** The depth of the sample collected from the base of the air shaft is suspect- the actual depth is likely to be much shallower(see report for further discussion). Therefore the data are not included in this figure.

Ringwood Mines/Landfill Site
Ringwood, New Jersey
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PETERS MINE PIT
CFC^{12} CROSS SECTION

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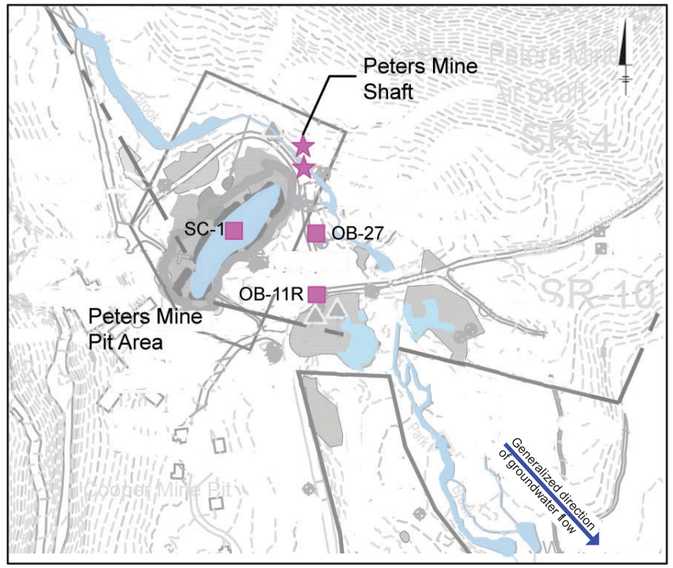
FIGURE 42

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



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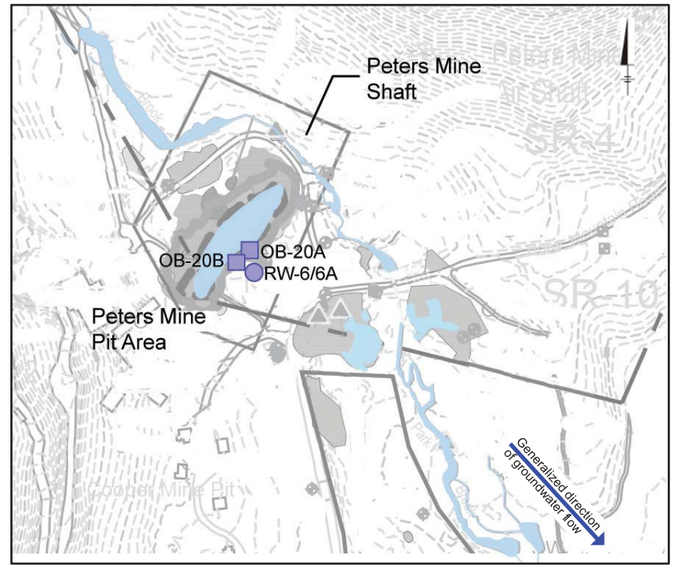

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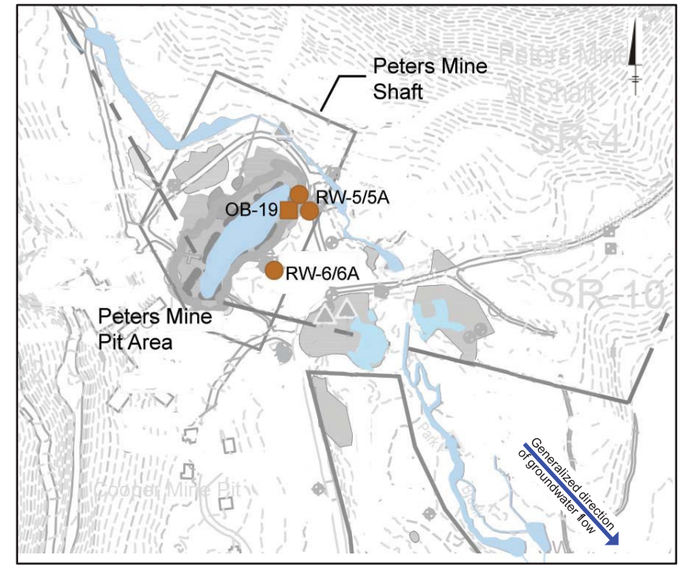

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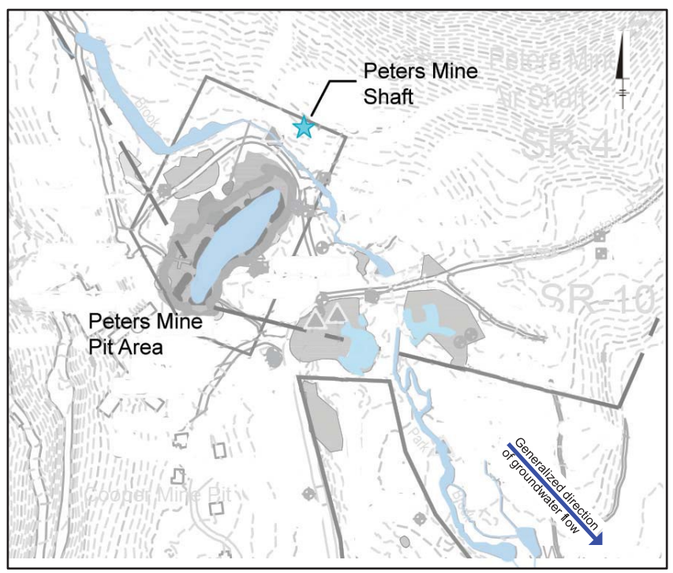
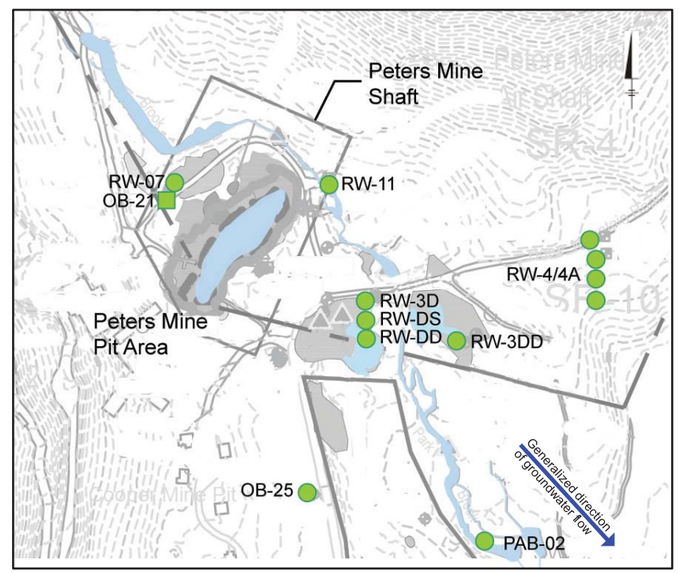


D



E

KEY:

- Surface Water Sample
- Overburden Sample
- Bedrock Sample
- Mine Shaft Sample
- > 30 mg/L
- > 10 and ≤ 30
- > 1.0 and ≤ 10
- > 0.10 and ≤ 1.0
- < 0.10
- Paint Sludge Removal (SR) and Targeted Removal Areas
- Water Surface

- Highest iron concentrations clustered in middle portion of PMP Area in vicinity of PMP and PM Air Shaft.
- PM Air Shaft water has higher iron concentration than nearby MW-11 water indicating limited connection between shaft water and local bedrock groundwater.

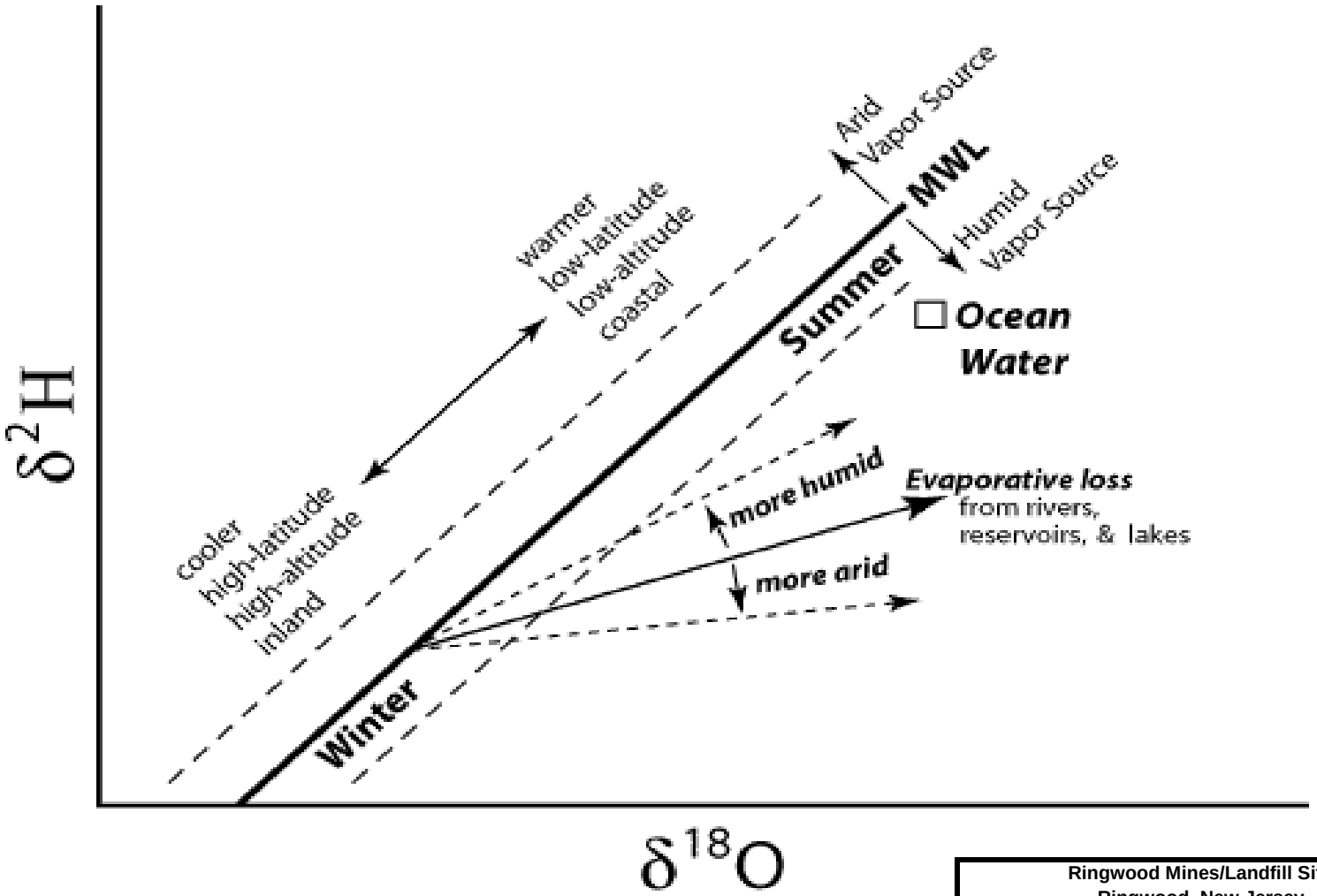
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PETERS MINE PIT
IRON CONCENTRATIONS IN GROUNDWATER AND SURFACE WATER (2012)

ARCADIS

FIGURE 43

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Plan View Figures_022614.pptx



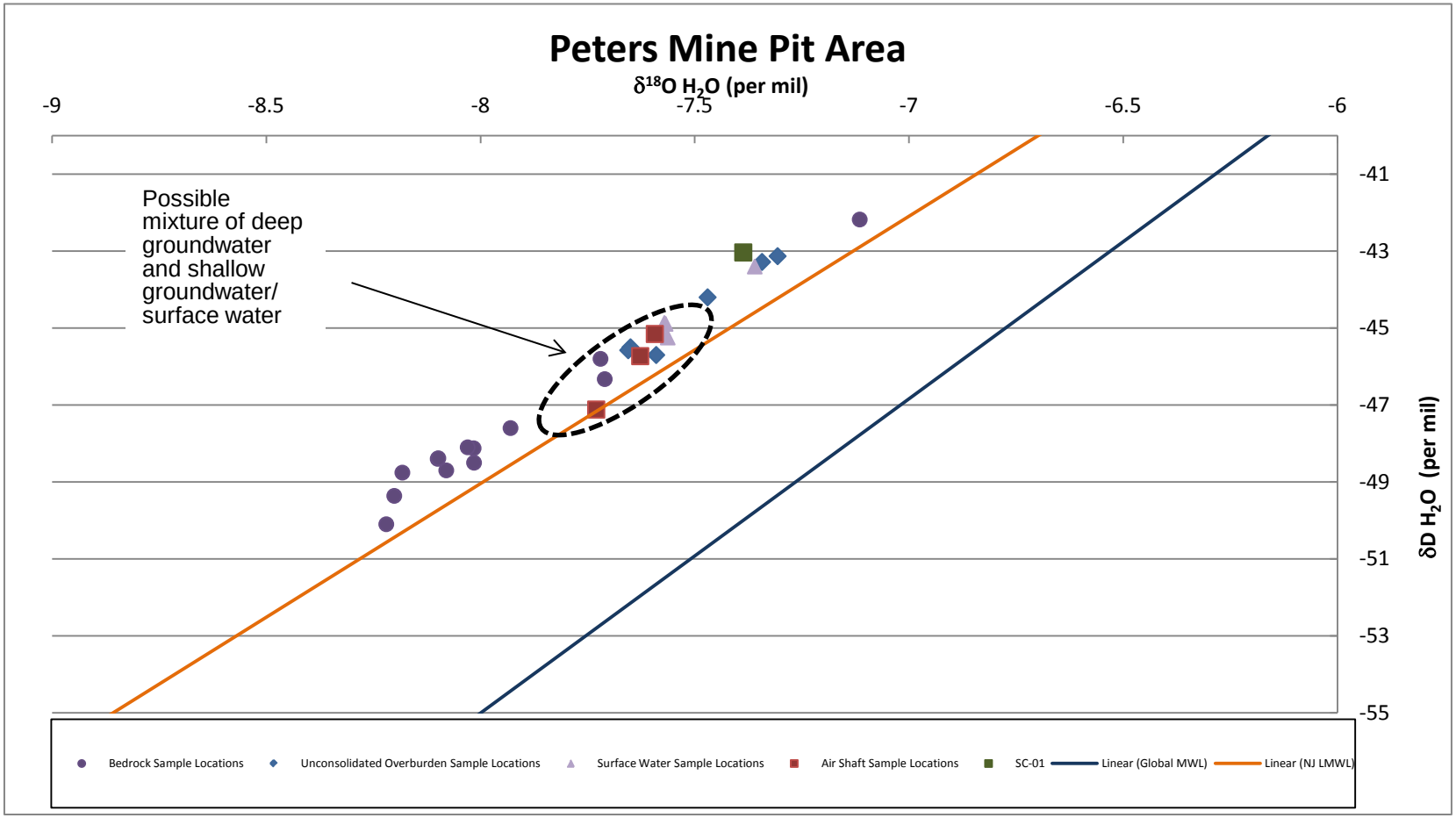
Source: SAHRA 2012
MWL: Meteoric Water Line
$\delta^{18}O$: ratio of oxygen-18 to oxygen-16 isotopes, relative to a standard, in units of parts per thousand (per mil, ‰)
δ^2H H2O: ratio of hydrogen-2 to hydrogen-1 isotopes, relative to a standard, in units of parts per thousand (per mil, ‰)

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Affect of Hydrologic Processes on Oxygen and Hydrogen Isotopic Composition

ARCADIS

Figure
44



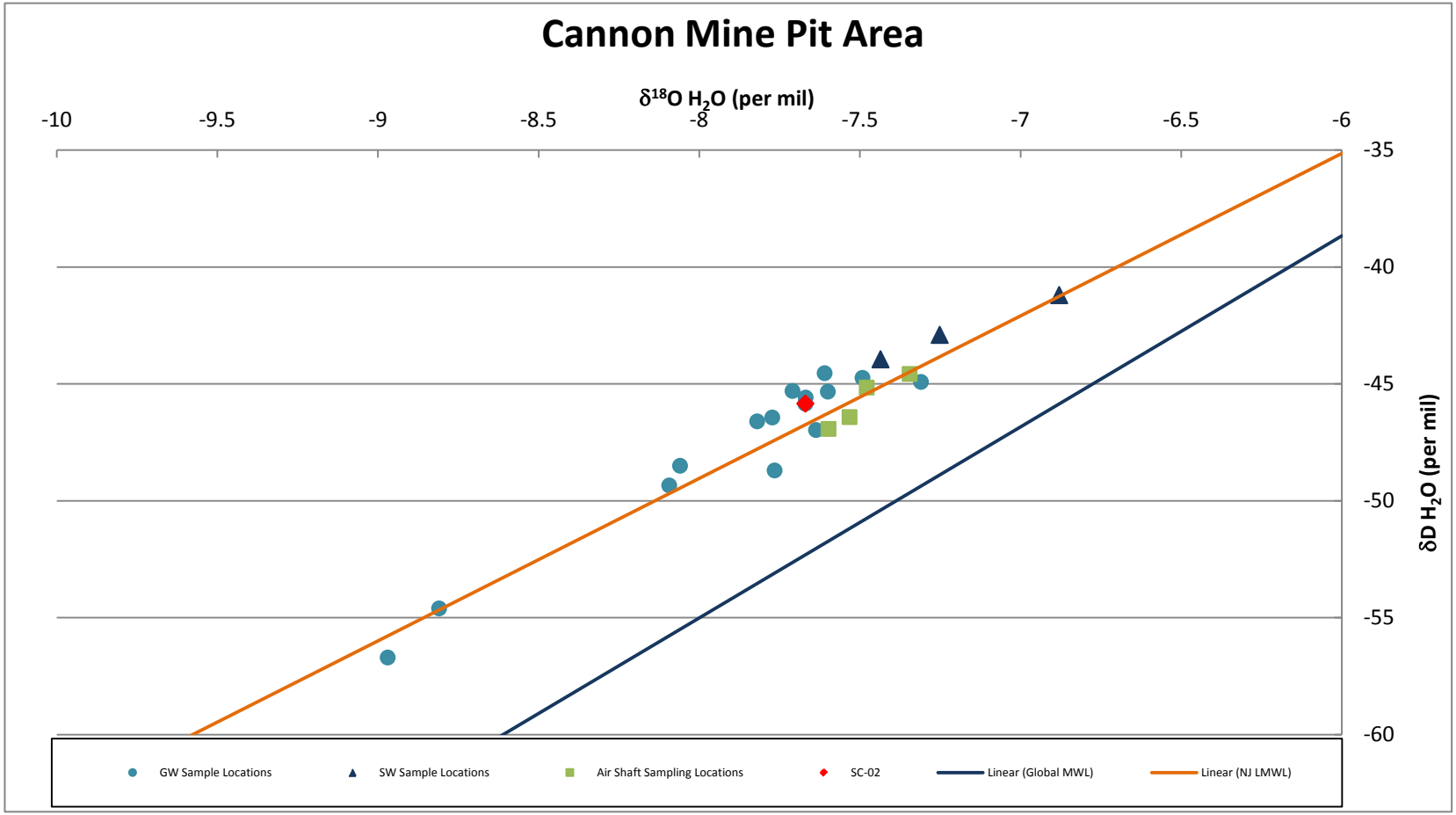
MWL: Meteoric Water Line
NJ LMWL: New Jersey Local Meteoric Water Line
PMP: Peters Mine Pit
$\delta^{18}O$ H_2O: ratio of oxygen-18 to oxygen-16 isotopes, relative to a standard, in units of parts per thousand (per mil, ‰)
δD H_2O: ratio of hydrogen-2 to hydrogen-1 isotopes, relative to a standard, in units of parts per thousand (per mil, ‰)

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Oxygen-18 and Deuterium Concentrations PMP Area

ARCADIS

Figure
45



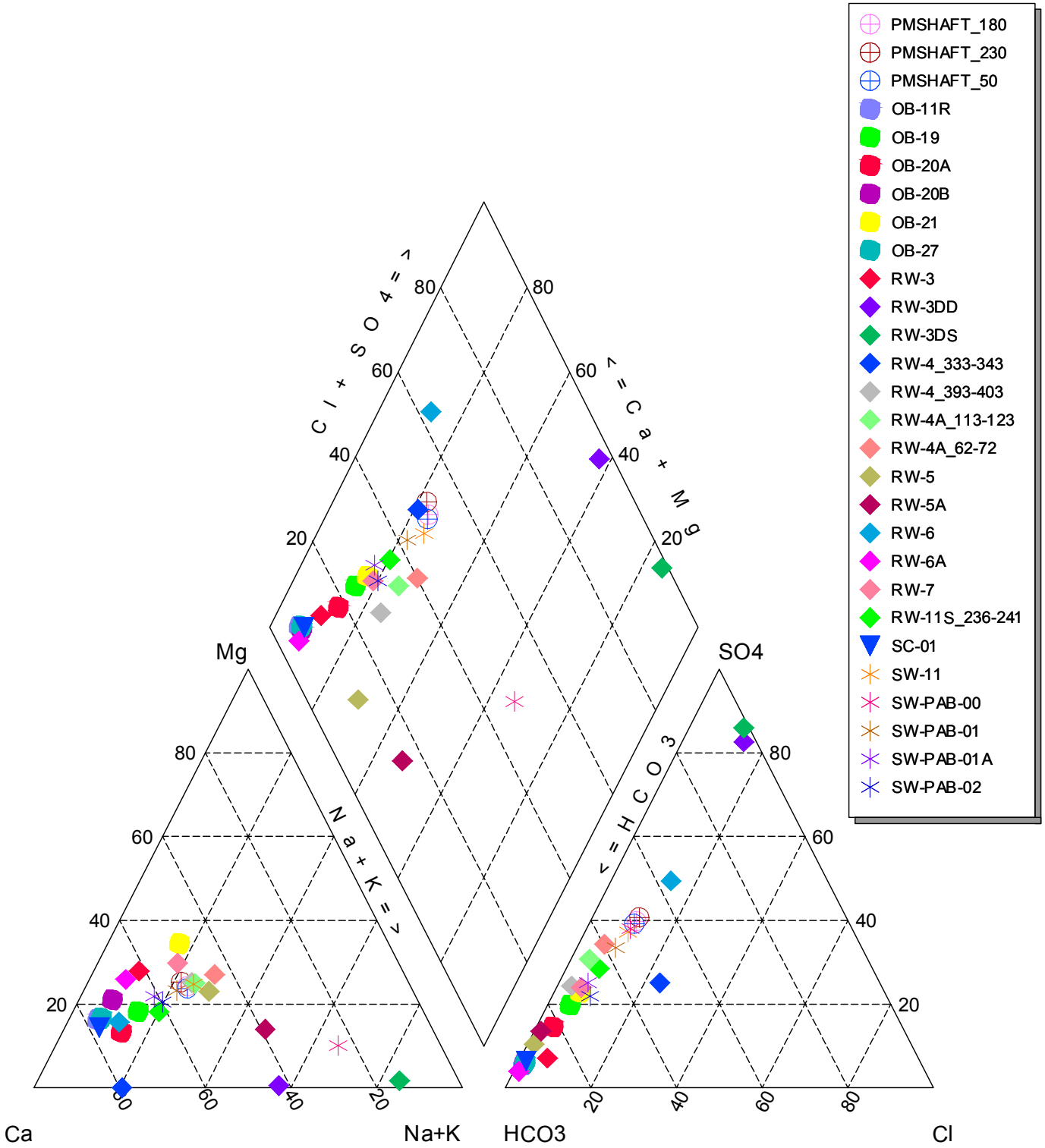
GW: groundwater
SW: surface water
MWL: Meteoric Water Line
NJ LMWL: New Jersey Local Meteoric Water Line
CMP: Canon Mine Pit
$\delta^{18}O$ H_2O: ratio of oxygen-18 to oxygen-16 isotopes, relative to a standard, in units of parts per thousand (per mil, ‰)
δD H_2O: ratio of hydrogen-2 to hydrogen-1 isotopes, relative to a standard, in units of parts per thousand (per mil, ‰)

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Oxygen-18 and Deuterium Concentrations CMP Area

ARCADIS

Figure
46



Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

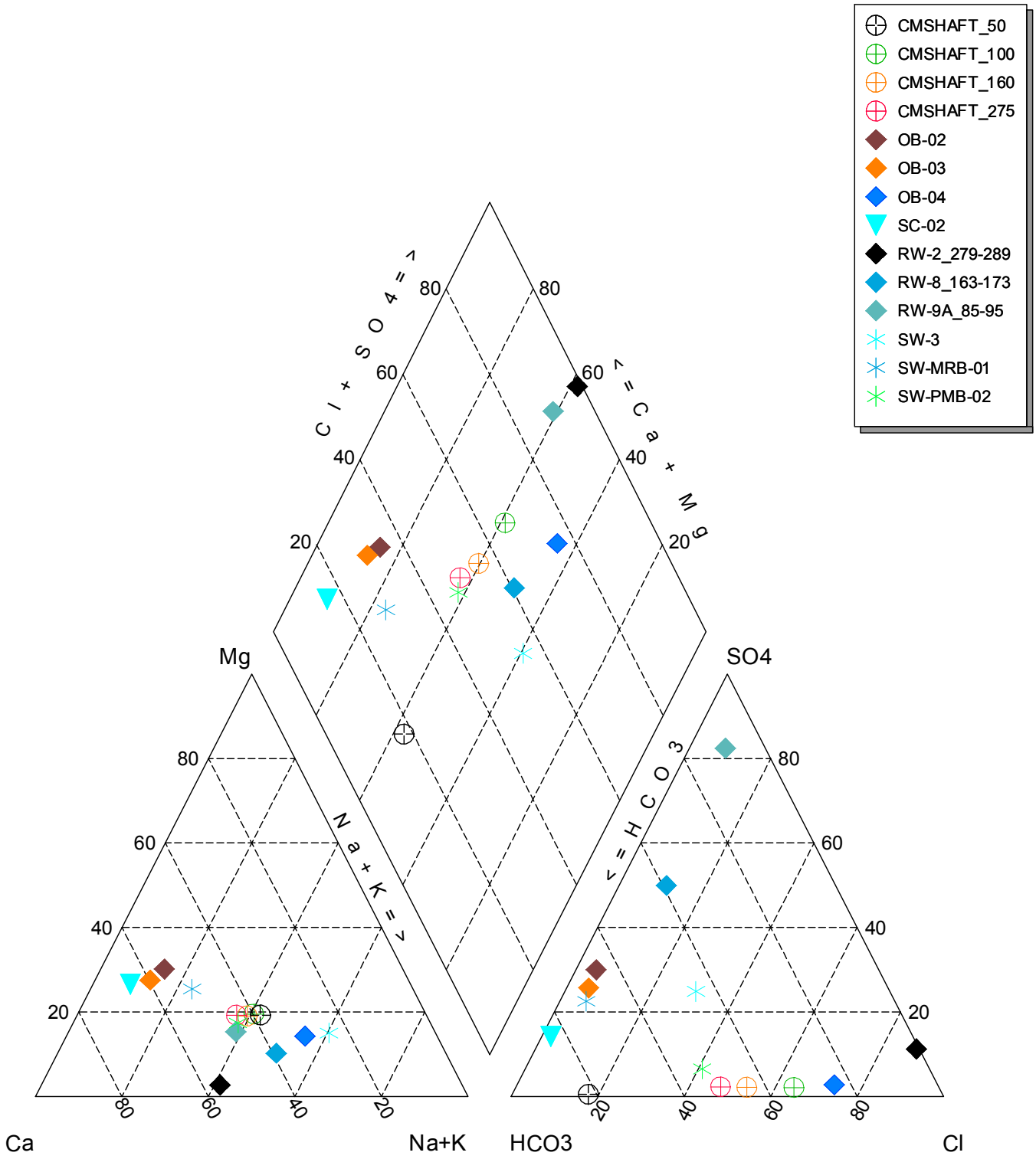
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PMP AREA PIPER DIAGRAM

ARCADIS

FIGURE
47A

CITY: Newtown, Pa DIV/GROUP: ENV DB: M. Wasilewski LD: M. Wasilewski PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2013\00035\2014-02\GW\FIG-47A Piper Diagram PMP.dwg LAYOUT: 47A SAVED: 2/28/2014 9:03 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS(SIZE A-B).CTB PLOTTED: 2/28/2014 9:04 AM BY:
WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----



LEGEND

CMP CANNON MINE PIT

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

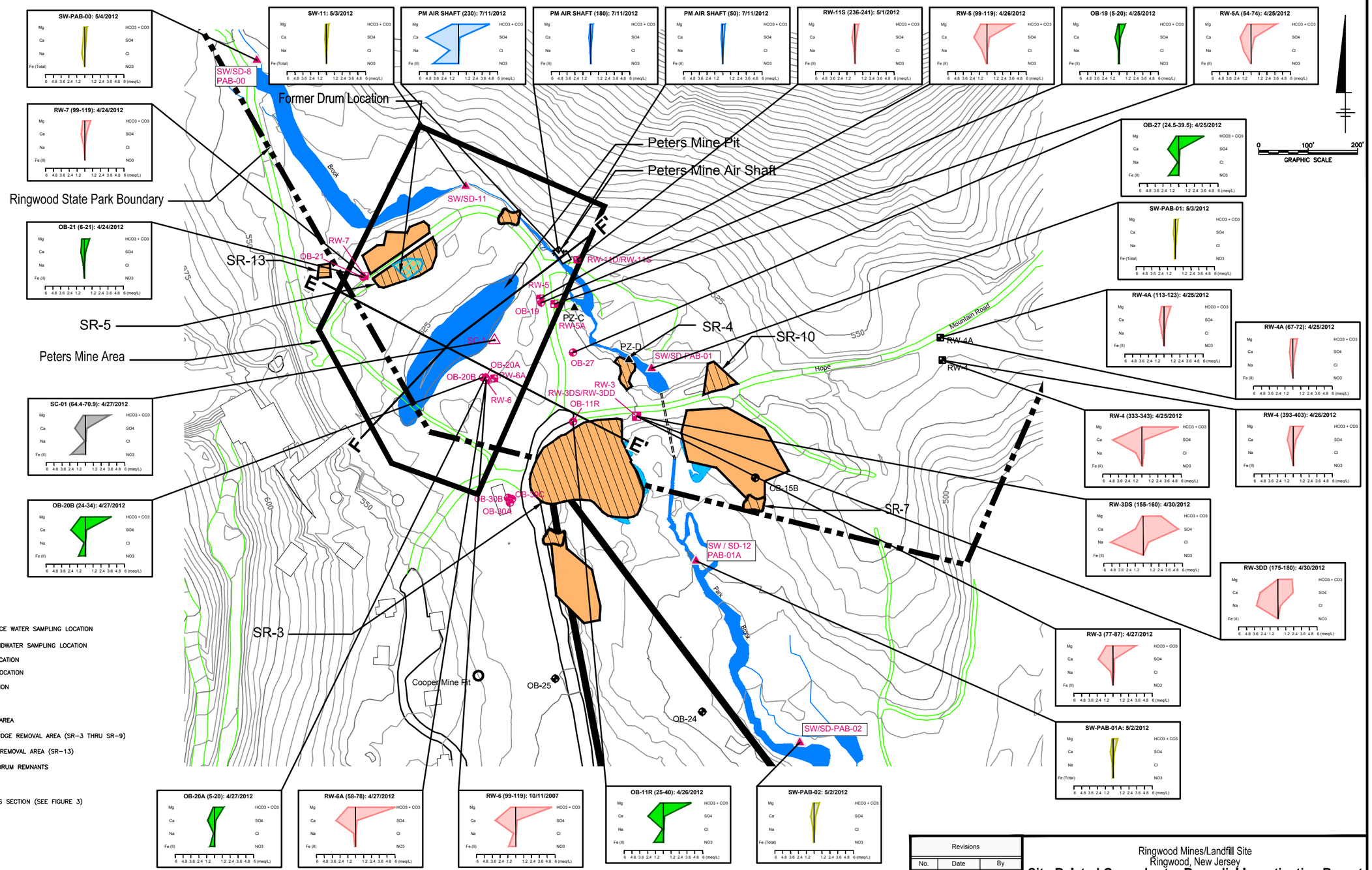
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

CMP AREA PIPER DIAGRAM

ARCADIS

FIGURE
47B

CITY: Newtown, Pa DIV/GROUP: ENV DB: M. Wasilewski LD: M. Wasilewski PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ000604\2013\00035\2014-02\GW\FIG-47B Piper Diagram CMP.dwg LAYOUT: 47B SAVED: 2/28/2014 9:01 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: ARCADIS(SIZE A-B).CTB PLOTTED: 2/28/2014 9:05 AM BY:
WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ---



LEGEND

- SUPPLEMENTAL RI SURFACE WATER SAMPLING LOCATION
- SC-1 SUPPLEMENTAL RI GROUNDWATER SAMPLING LOCATION
- DEEP BEDROCK WELL LOCATION
- UNCONSOLIDATED WELL LOCATION
- DIRECTIONAL WELL LOCATION
- PETERS MINE AIR SHAFT
- PAINT SLUDGE REMOVAL AREA
- 2006 – 2009 PAINT SLUDGE REMOVAL AREA (SR–3 THRU SR–9)
- CURRENT PAINT SLUDGE REMOVAL AREA (SR–13)
- SUBSURFACE DRUM OR DRUM REMNANTS
- DIRT ROAD
- E——E' LINE OF GEOLOGIC CROSS SECTION (SEE FIGURE 3)

STIFF DIAGRAMS

- PMP AIR SHAFT
- PMP OVERBURDEN WELL
- PMP BEDROCK WELL
- PMP SURFACE WATER
- PMP PIT WELL

NOTE:

EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
Ringwood, New Jersey

Site-Related Groundwater Remedial Investigation Report

2012 PMP STIFF DIAGRAMS

ARCADIS

FIGURE
48A

CITY:NAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
C:\ENVCAD\NEWTOWNACT\2014\RETURN-TO\Cranbury-NJ\NJ00684\2014\00011\GIV\RIR\FIG 48A - PMP AREA STIFF DIAGRAMS - 2012.dwg LAYOUT: 48A SAVED: 2/28/2014 10:31 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-RINGWOOD.CTB PLOTTED: 11/25/2014 8:14 AM BY: WASILEWSKI, MATT
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contours-svsd14
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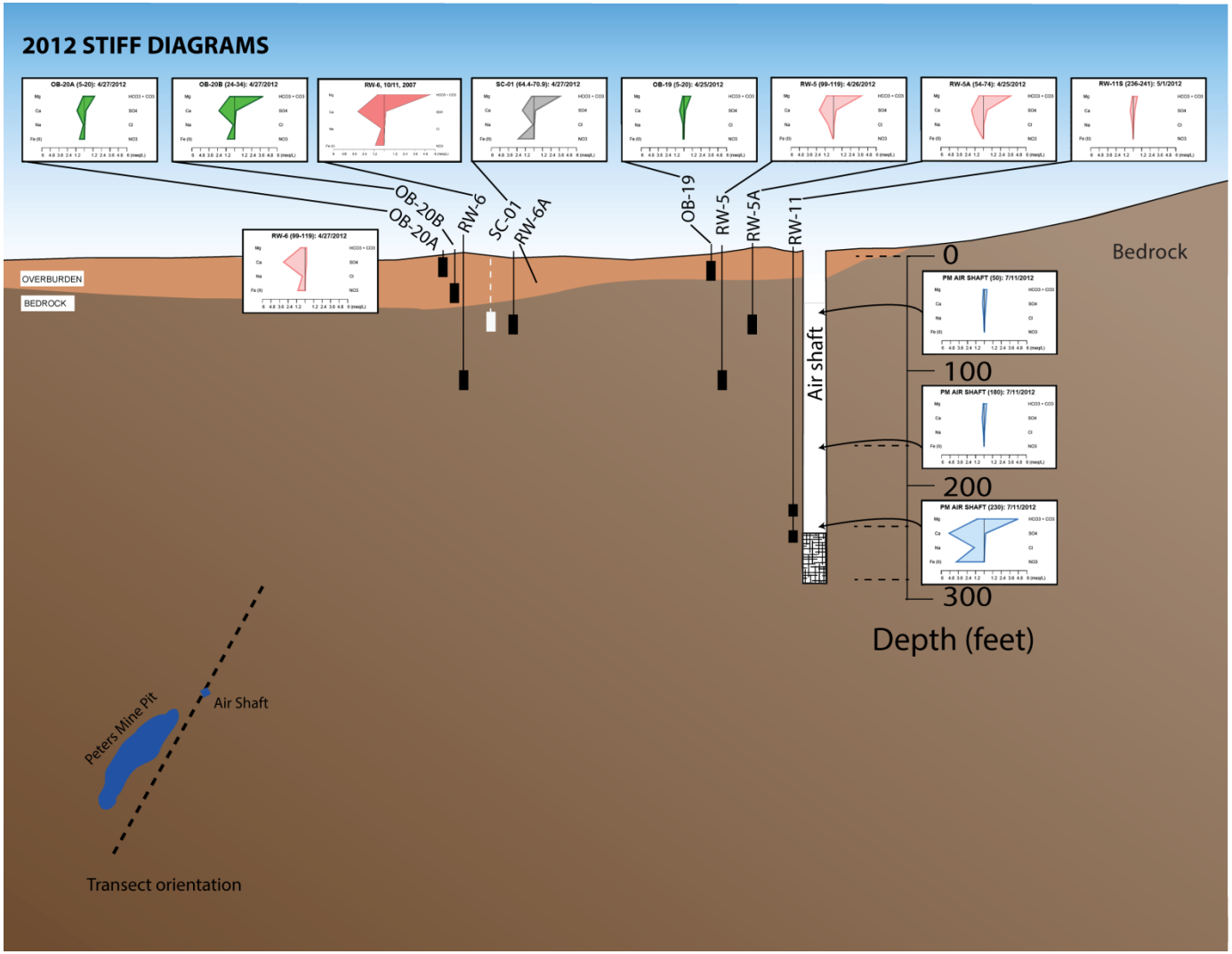


- Elevated iron and manganese, depleted sulfate and nitrate concentrations in groundwater, and the co-occurrence of elevated methane/carbon dioxide (not shown on this figure) are indicative of on-going oxidation of organic carbon and microbial activity with the PMP and PM Air Shaft.
- The absence of elevated iron and manganese in groundwater at RW-11 adjacent to the PM Air Shaft confirms minimal hydraulic connectivity between the air shaft and RW-11.
- Elevated iron, manganese, and alkalinity in groundwater at downgradient well RW-5/5A indicates some vertical communication between shallow bedrock and the deeper part of the air shaft in the direction of RW-5.

Key:

Green diagrams represent data for Overburden Wells

Pink diagrams represent data for Bedrock Wells

Blue diagrams represent data for the Air Shaft

Note the diagram for 2012 was replaced with one from 2007 because the 2012 data are not representative.

The Stiff Diagrams show:

- The ratio of cations (the metals magnesium, calcium, sodium and iron) to anions (nitrate, sulfate, chloride and bicarbonate + carbonate).
- The units are in milliequivalents per liter (meg/L).

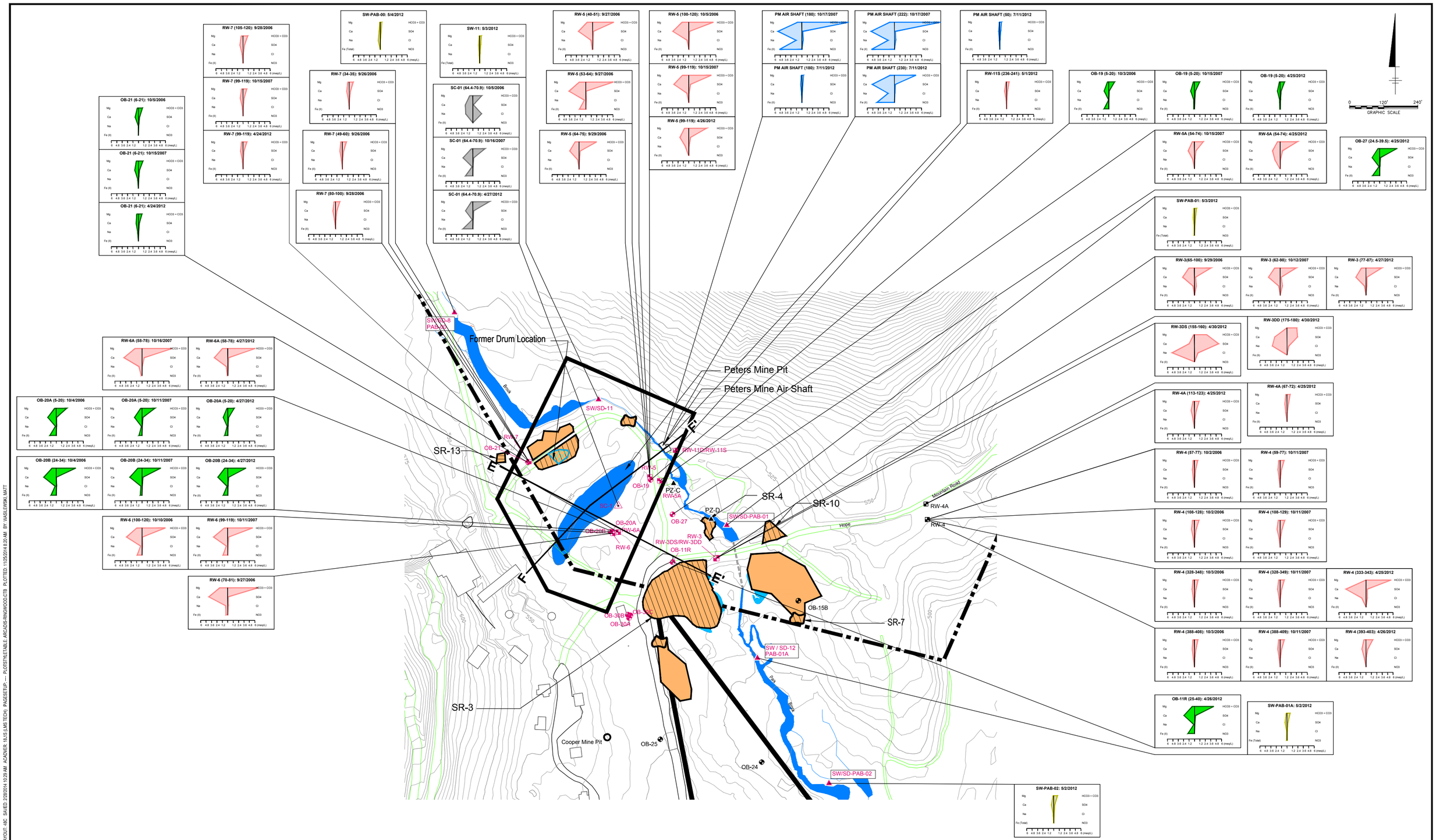
Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

PETERS MINE PIT
2012 STIFF DIAGRAMS CROSS SECTION

ARCADIS

FIGURE 48B

C:\Users\bbutterly\Documents\Ringwood\GW RIR\FEB 2014 REVISION\Final Figures\Geochem Cross Section Figures_022614.pptx



LEGEND

- SUPPLEMENTAL RI SURFACE WATER SAMPLING LOCATION
- SC-1 SUPPLEMENTAL RI GROUNDWATER SAMPLING LOCATION
- DEEP BEDROCK WELL LOCATION
- UNCONSOLIDATED WELL LOCATION
- DIRECTIONAL WELL LOCATION
- PETERS MINE AIR SHAFT
- PAINT SLUDGE REMOVAL AREA
- 2006 – 2009 PAINT SLUDGE REMOVAL AREA (SR-3 THRU SR-9)
- CURRENT PAINT SLUDGE REMOVAL AREA (SR-13)
- SUBSURFACE DRUM OR DRUM REMNANTS
- DIRT ROAD
- E——E' LINE OF GEOLOGIC CROSS SECTION (SEE FIGURE 3)

STIFF DIAGRAMS

STIFF DIAGRAMS

- PMP AIR SHAFT
- PMP OVERBURDEN WELL
- PMP BEDROCK WELL
- PMP SURFACE WATER
- PMP PIT WELL

NOTE:

EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiarol
2	11/24/2014	M. Kleczkowski

Ringwood Mines/Landfill Site
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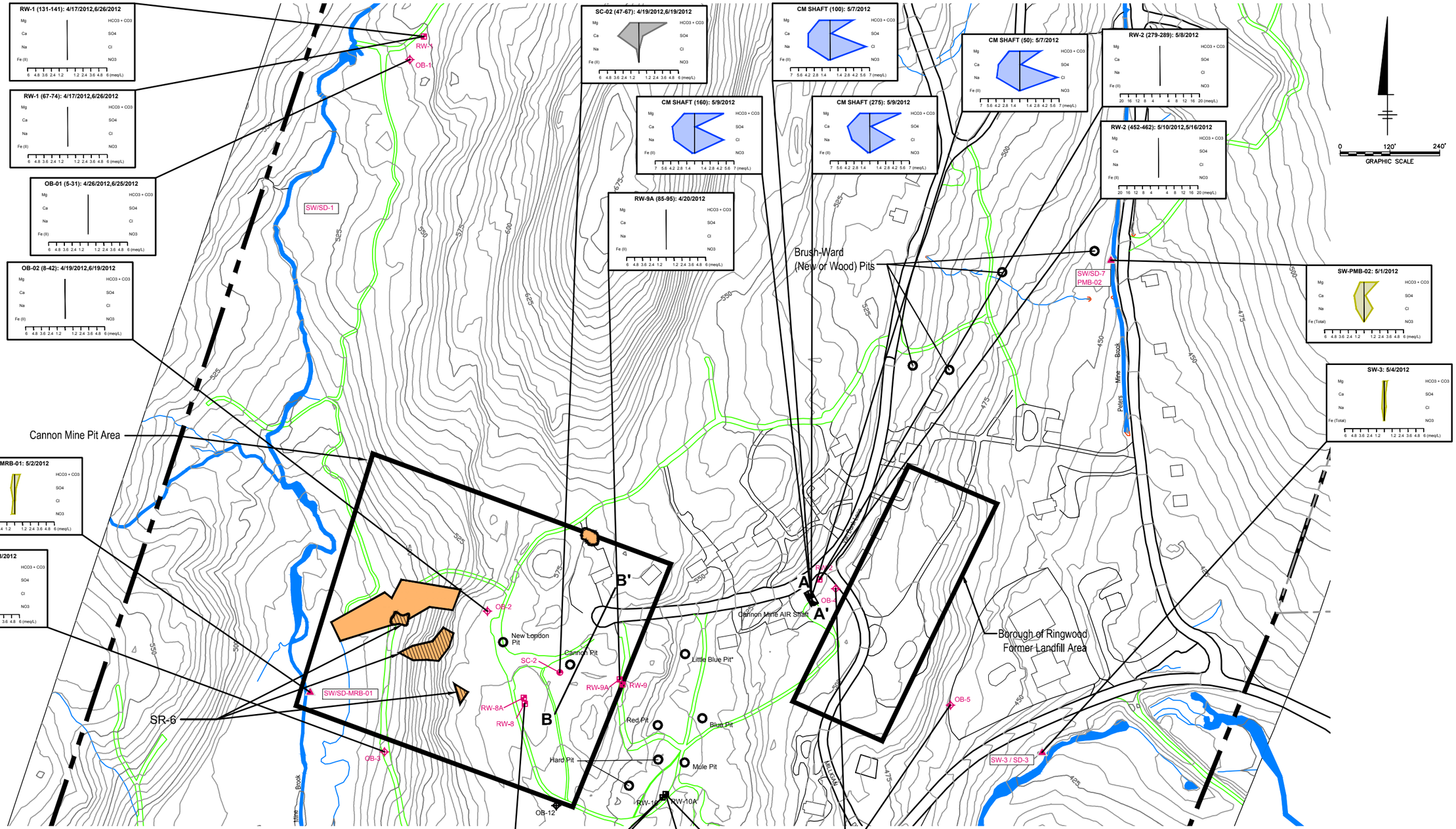
COMPARISON OF PMP 2006, 2007, AND 2012 STIFF DIAGRAMS

ARCADIS

FIGURE
48C

CITY: Newtown Pa DIV/GROUP: ENV DB: M. Wasilewski LD: M. Wasilewski PIC: (Opt) PM: (Reqd) TM: (Opt) LYR: (On)*(Off)*REF*
C:\ENVCAD\NEWTOWN\ACT\2014\RETURN-TO\Cranbury-NJ\NJ0086\60214000\1\GWRI\FIG 48C - PMP AREA STIFF DIAGRAMS - COMP.dwg LAYOUT: 48C SAVED: 2/28/2014 10:29 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-RINGWOOD.CTB PLOTTED: 11/25/2014 8:20 AM BY: WASILEWSKI, MATT
XREFS: 218GRAL_R1-2009A.SID ASE-CANYOUKASSAV.SID contours-wet14_1ft-NAD83.SID
IMAGES: PROJECT NAME: ----



LEGEND

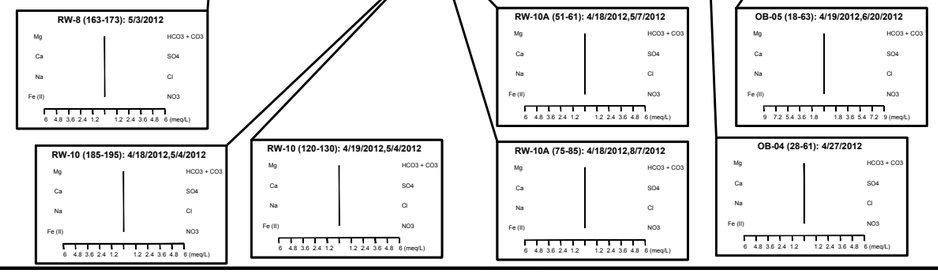
- SUPPLEMENTAL RI SURFACE WATER SAMPLING LOCATION
- SUPPLEMENTAL RI GROUNDWATER SAMPLING LOCATION
- DEEP BEDROCK WELL LOCATION
- UNCONSOLIDATED WELL LOCATION
- DIRECTIONAL WELL LOCATION
- Cannon — ABANDONED MINE PIT
- Cannon Mine Air Shaft — ABANDONED MINE SHAFT ENTRANCE
- PAINT SLUDGE REMOVAL AREA
- 2006 – 2009 PAINT SLUDGE REMOVAL AREA (SR–3 THRU SR–9)
- DIRT ROAD
- A — A' LINE OF GEOLOGIC CROSS SECTION (SEE FIGURES 5 AND 6)

STIFF DIAGRAMS

- CMP AIR SHAFT
- CMP BEDROCK WELL
- CMP SURFACE WATER
- CMP PIT WELL

NOTE:

EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.



Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

Ringwood Mines/Landfill Site
Ringwood, New Jersey

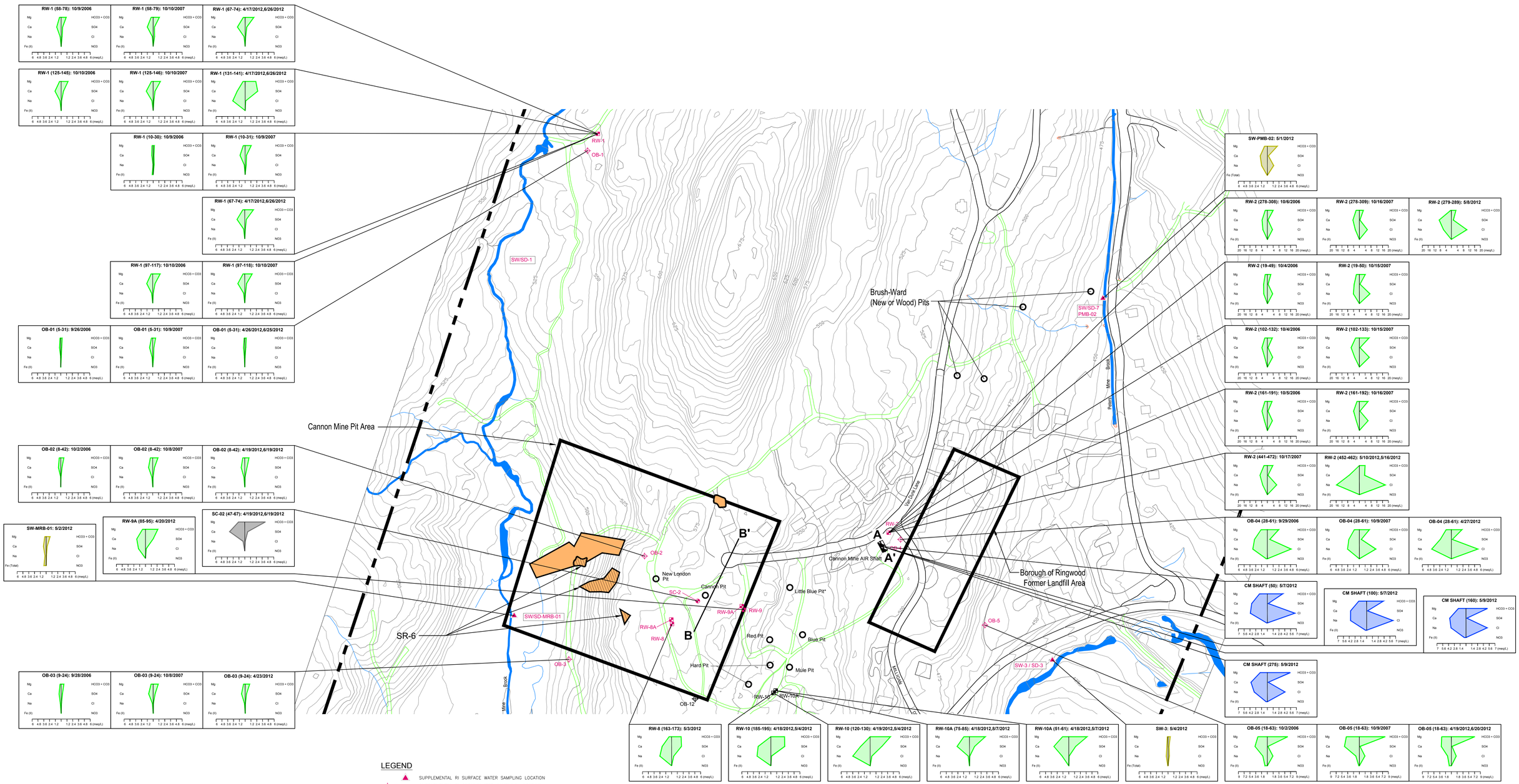
Site-Related Groundwater Remedial Investigation Report

2012 CMP STIFF DIAGRAMS

ARCADIS

FIGURE
48D

CITY:MAHWAH DIV/GROUP:ENVCAD DB:JG LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACTREURN-TO\Fairlawn-NJ\J0006840\2013\00035\2014-02\GWFIG 48D- CMP AREA STIFF DIAGRAMS - 2012.dwg LAYOUT: 48D SAVED: 2/28/2014 9:16 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.RINGWOOD.CTB PLOTTED: 2/28/2014 10:25 AM BY: WASILEWSKI, MATT
XREFS: 2182BRKL_R1-2013 XSE-CONTOURS contours-swsd14
IMAGES:
PROJECTNAME: ----



LEGEND

- SUPPLEMENTAL RI SURFACE WATER SAMPLING LOCATION
- SUPPLEMENTAL RI GROUNDWATER SAMPLING LOCATION
- DEEP BEDROCK WELL LOCATION
- UNCONSOLIDATED WELL LOCATION
- DIRECTIONAL WELL LOCATION
- BEDROCK WELL LOCATION
- Cannon — ABANDONED MINE PIT
- Cannon Mine Air Shaft — ABANDONED MINE SHAFT ENTRANCE
- PAINT SLUDGE REMOVAL AREA
- 2006 – 2009 PAINT SLUDGE REMOVAL AREA (SR–3 THRU SR–9)
- DIRT ROAD
- A — A' LINE OF GEOLOGIC CROSS SECTION (SEE FIGURES 5 AND 6)

STIFF DIAGRAMS

- CMP AIR SHAFT
- CMP BEDROCK WELL
- CMP SURFACE WATER
- CMP PIT WELL

NOTE:

EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

COMPARISON OF CMP 2006, 2007, AND 2012 STIFF DIAGRAMS

ARCADIS

FIGURE
48E

CITY: Newtown Pa DIV/GROUP: ENV DB: M. Wisniewski LD: M. Wisniewski PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(On)(On*OFF*FREZ*
G:\ENVCAD\Newtown\ACT\RETURN-TO\Fairlawn-NJ\NJ0006x\2013\00353\2014-02\GW\FIG 48E - CMP AREA STIFF DIAGRAMS - COMP.dwg LAYOUT: 48E SAVED: 2/28/2014 8:13 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-RINGWOOD.CTB PLOTTED: 2/28/2014 10:34 AM BY: WASILENSKI, MATT
XREFS: IMAGES:
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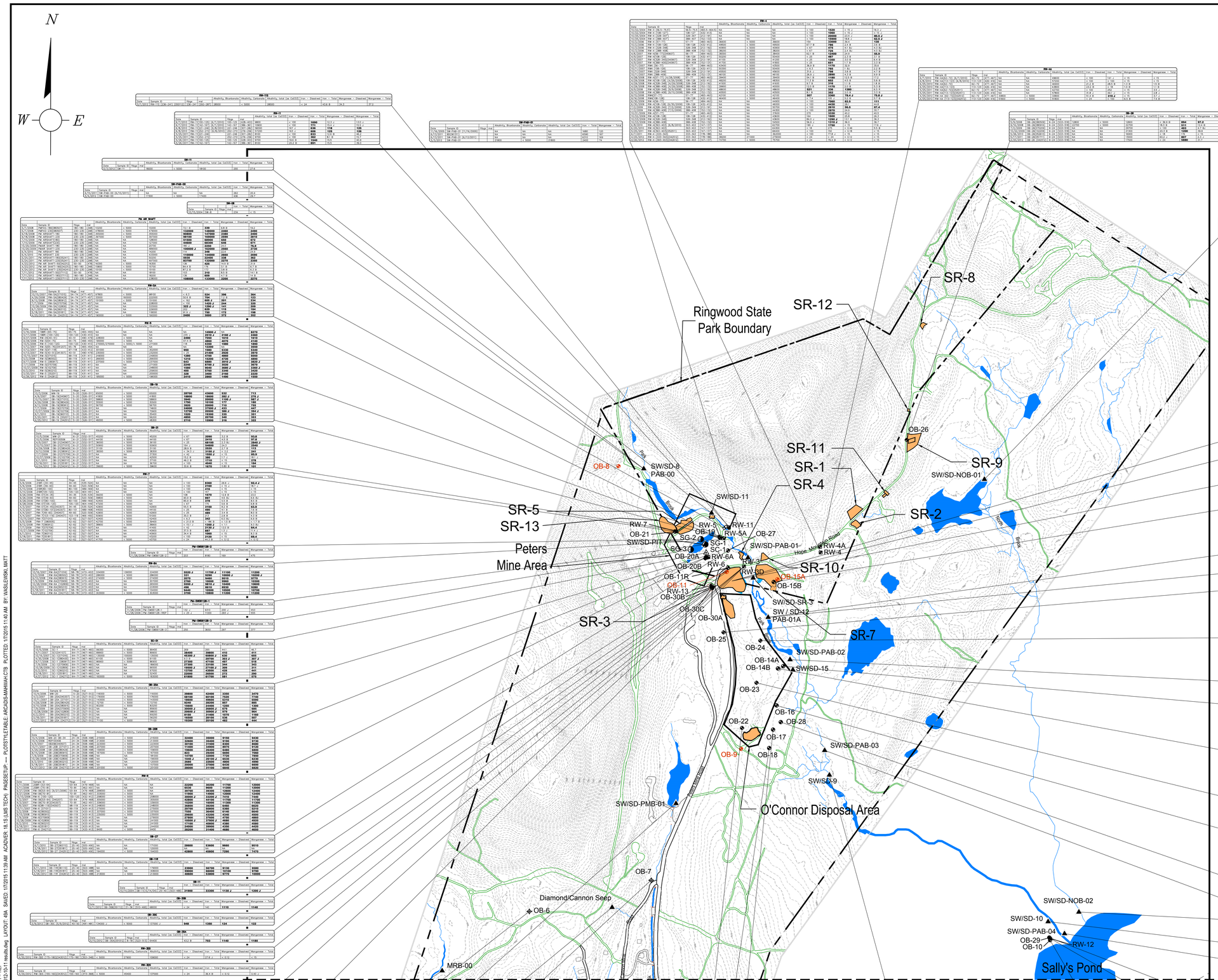
X3E-CONTOURS3A2.SID
contours-used-1-15A.SID
J3A6.SID
PROJECTNAME: ----



MATCHLINE CONTINUES ON SHEET 'X-8'

SAMPLE ID
SAMPLE DATE
CONSTITUENT

LEGEND

- BEDROCK WELL
- DEEP BEDROCK WELL
- DIRECTIONAL WELL
- UNCONSOLIDATED WELL
- MONITORING WELL DAMAGED OR NOT AVAILABLE FOR SAMPLING
- PAINT SLUDGE REMOVAL AREA
- SW/SD-2 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION
- SW/SD-MRB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM MINE BROOK
- SW/SD-PMB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PETERS MINE BROOK
- SW/SD-NOB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM NORTH BROOK
- SW/SD-PAB-01 — SURFACE WATER AND SEDIMENT – SAMPLE LOCATION FROM PARK BROOK
- SG-1 — STAFF GUAGE

RESULTS ARE PRESENTED IN MICROGRAM PER LITER (uG/L).

ND	NOT DETECTED.
NA	NOT ANALYZED.
NS	NO STANDARD.
<	LESS THAN
SVOC	SEMI-VOLATILE ORGANIC COMPOUND.
VOC	VOLATILE ORGANIC COMPOUND.
PCBS	POLYCHLORINATED BIPHENYLS.
BOLD	VALUE IS ABOVE THE NJDEP GROUNDWATER/SURFACE WATER QUALITY STANDARDS (GWQS/SWQS)
ftbgs	FEET BELOW GROUND SURFACE
msl	MEAN SEA LEVEL
USEPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.
	SHADED – SHADED VALUES ARE ABOVE THE USEPA MAXIMUM CONTAMINANT LEVEL (MCL).
*	DETECTION LIMIT IS ABOVE THE 2005 SWQS STANDARD.

- TRAIL/ DIRT ROAD
- WATER BODY
- STREAM
- INFERRED STREAM

NOTES:

1. DATA QUALIFIERS ARE REPORTED IN THE ANALYTICAL TABLES.
2. WHEN A DUPLICATE SAMPLE ANALYSIS WAS PERFORMED, THE DATA REPORTED ON THE DRAWING IS THE GREATER OF THE TWO ANALYTICAL RESULTS.
3. EXISTING CONTOURS DEPICT TOPOGRAPHY PRIOR TO REMOVAL ACTIVITIES.
4. ALL RESULTS ARE PRESENTED AS MICROGRAM PER LITER (ug/L).
5. CONCENTRATIONS OF METALS ARE SHOWN FOR THE UNFILTERED SAMPLES, OR TOTAL METAL CONCENTRATIONS.

0 300' 600'
GRAPHIC SCALE

Revisions		
No.	Date	By
1	2/27/2014	P. Macchiaroli

Ringwood Mines/Landfill Site
Ringwood, New Jersey

Site-Related Groundwater Remedial Investigation Report

SITE-WIDE IRON, MANGANESE AND ALKALINITY CONCENTRATIONS IN SURFACE WATER AND GROUNDWATER NOVEMBER 2004 THROUGH MAY 2012

ARCADIS

FIGURE **49A**

CTY:MAHWAH DIV:GROUP:ENVCAD DB:JG LD:(0pt) PC:(0pt) PM:(Reqd) TM:(0pt) LYR:(0ff)ON=*;OFF=*REF*
G:\ENVCAD\Newtown\ACT\PETERN-TOF\drafting\AJN\A0000\20140301\TOWGF\49-A,B GWSWV Ni, Mn, Fe - 2012-13-11 results.dwg LAYOUT: 49A SAVED: 1/7/2015 11:39 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-MAHWAH.CTB PLOTTED: 1/7/2015 11:40 AM BY: WASILEWSKI, MATT
XREFS: IMAGES: PROJECTNAME: ----

N

W — E

OB-01

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
11/7/2004	OB-1(101204)	5–31	(538–512)	NA	NA	NA	< 100	< 100	< 15	< 15
12/30/2004	OB-1(123004)	5–31	(538–512)	NA	NA	NA	< 100	**869**	< 15	< 15
9/28/2006	OB-1(9/28/2006)	5–31	(538–512)	9100	< 5000	9100	< 67	115	3.7 BJ	3.9 BJ
4/8/2007	OB-1(040607)	5–31	(538–512)	20600	< 5000	20600	< 25	80.3 B	1.1 B	1.4 B
10/9/2007	OB-1(100907)	5–31	(538–512)	29700	< 5000	29700	< 67	201	< 0.17	3.4 B
4/30/2008	OB-1(080430)	5–31	(538–512)	8900	< 5000	8900	13.5 B	**649**	1.9 BJ	2.6 BJ
10/7/2008	OB-1(081007)	5–31	(538–512)	14600	< 5000	14600	< 7.4	< 7.4	< 0.24	< 0.24
2/2/2009	OB-1(020209)	5–31	(538–512)	NA	10500	< 100	< 100	123 J	4.0 BJ	< 15
10/22/2009	OB-1(102209)	5–31	(538–512)	NA	14400	< 100	< 100	99.9 B	< 15	< 15
5/26/2010	OB-1(052610)	5–31	(538–512)	NA	11400	< 100	< 18	256	< 0.46	4.4 J
5/26/2011	OB-1 (052611)	5–31	(538–512)	NA	45900	< 100	< 100	**413**	1.3 B	4.8 B
6/29/2012	OB-1 (062612)	5–31	(538–512)	NA	14600	< 100	< 24	**1310**	1.7 J	11.1 B
6/29/2012	OB-1	5–31	(538–512)	14600	< 5000	14600	< 100	**656**	2.4 J	8.0 B

RW-1

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
11/7/2004	RW-1(101104)			NA	NA	NA	< 100	**5140**	< 15	32.2
3/30/2005	RW-1(125.5–135) (3/30/05)	125.5–135	(423.5–398)	NA	NA	NA	< 100	566	< 15	16.0
4/1/2005	RW-1(10–30)(4/1/05)	10–30	(538–518)	NA	NA	NA	< 100	**1050**	< 15	21.1
4/1/2005	RW-1(58–78)(4/1/05)	58–78	(491–471)	NA	NA	NA	< 100	**662**	< 15	18.9
4/1/2005	RW-1(97–117)(4/1/05)	97–117	(452–432)	NA	NA	NA	< 100	**346**	< 15	23.3
10/9/2006	RW-1 (10–30)	10–30	(538–518)	12400/12400	< 5000/< 5000	12400	**5030**	**3910**	**118**	**113**
10/9/2006	RW-1 (58–78)	58–78	(491–471)	52100/52100	< 5000/< 5000	52100	< 67	**641**	4.0 B	15.9
10/10/2006	RW-1 (97–117)	97–117	(452–432)	76500	< 5000	76500	< 67	**1410 J**	27.4	**124**
10/10/2006	RW-1 (125–145)	125–145	(424–404)	70800	< 5000	71000	< 67	211 J	34.7	44.0
4/18/2007	RW-1(10–31)(041807)	10–31	(538–517)	< 5000	< 5000	< 25	42.5 B	10.4 B	19.4	19.4
4/18/2007	RW-1(58–79)(041807)	58–79	(491–470)	9700	< 5000	9700	< 25	152	5.0 B	28.0
4/18/2007	RW-1(97–118)(041807)	97–118	(452–431)	75500	< 5000	75500	< 25	< 25	0.99 B	2.5 BJ
4/18/2007	RW-1(125–146)(041807)	125–146	(424–403)	70200	< 5000	70400	< 25	< 25	11.6 B	15.7
10/9/2007	RW(10–31)	10–31	(538–517)	15500	< 5000	15700	15.7 B	**5970**	13.9 B	**171**
10/10/2007	RW(58–79)	58–79	(491–470)	64100	< 5000	64100	10.3 B	45.8 B	2.2 B	3.2 B
10/10/2007	RW(97–118)	97–118	(452–431)	76200	< 5000	76900	10.3 B	117	1.8 B	7.8 B
10/10/2007	RW(125–146)	125–146	(424–403)	74300	< 5000	74700	12.6 B	147	19.4	26.3
5/8/2008	RW(11–31) (080508)	11–31	(537–517)	7800	< 5000	7800	< 7.4	**699**	6.1 B	24.9
5/8/2008	RW(59–79) (080508)	59–79	(490–470)	50000	< 5000	50000	38.6 B	150	3.4 B	6.9 B
5/7/2008	RW–1(98–118) (5/7/2008)	98–118	(451–431)	78500	< 5000	78800	12.8 B	32.7 B	2.2 B	2.1 B
5/7/2008	RW–1(126–146) (5/7/08)	126–146	(423–403)	79200	< 5000	79700	28.0 B	85.9 B	22.0	23.4
9/19/2008	RW(11–31)	11–31	(537–517)	8600	< 5000	8600	< 7.4	**323**	5.4 B	11.5 B
9/19/2008	RW(59–79)	59–79	(490–470)	64700	< 5000	64800	< 7.4	< 7.4	2.3 B	2.4 B
9/19/2008	RW(98–118)	98–118	(451–431)	72000	< 5000	72400	< 7.4	48.4 BJ	1.8 B	2.0 B
9/22/2008	RW–1 (126–146)	126–146	(423–403)	74200	< 5000	74500	< 7.4	14.5 B	10.2 B	11.9 B
7/17/2009	RW–1(10–30)	10–30	(538–518)	NA	NA	14600	33.4 BJ	174 J	12.7 B	14.5 B
7/17/2009	RW–1(58–78)	58–78	(491–471)	NA	NA	75700	31.0 BJ	252	7.2 BJ	7.4 BJ
7/17/2009	RW–1(97–117)	97–117	(452–432)	NA	NA	83600	151	**304**	31.2	35.2
7/17/2009	RW–1(126–146) (7/17/2009)	126–146	(423–403)	NA	NA	106000	248	**2450**	**265**	**318**
10/20/2009	RW–1(10–31)	10–31	(537–517)	NA	NA	21300	222	**313**	2.0 B	11.3 J
10/20/2009	RW–1(59–79)	59–79	(490–470)	NA	NA	76300	42.4 B	277	7.2 B	8.7 J
10/20/2009	RW–1(98–118)	98–118	(451–431)	NA	NA	77400	25.1 B	**441 J**	46.1	**52.4**
10/20/2009	RW–1(126–146)	126–146	(423–403)	NA	NA	131000	**15700**	**19700**	**940**	**937**
6/30/2010	RW–1(64–74) (6/30/2010)	64–74	(485–475)	NA	NA	38200	< 18	**3600**	< 0.46	**206**
6/30/2010	RW–1(131–141) (6/30/2010)	131–141	(418–408)	NA	NA	129000	< 100	< 100	**284 J**	< 0.46 J
5/26/2011	RW–1(64–74)(052611)	64–74	(485–475)	NA	NA	63700	< 7.4	< 7.4	< 0.18	< 0.18
5/26/2011	RW–1(131–141)(052611)	131–141	(418–408)	NA	NA	126000	89.3 B	**26100**	213	**210**
4/17/2012	RW–1 (64–74)(041712)	64–74	(485–475)	NA	NA	93600	< 24	< 100	< 0.12	< 0.12
4/17/2012	RW–1 (131–141)(041712)	131–141	(418–408)	NA	NA	101000	186 J	**1740**	**168**	**182**
6/26/2012	RW–1(64–74)	64–74	(485–475)	NA	6000	89700	< 24	47.7 J	< 0.12	5.3 B
6/26/2012	RW–1(131–141)	131–141	(418–408)	109000	< 5000	110000	150	**1850**	**172**	**176**

RW-2

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
10/26/2004	RW–2 (19.0–48.5')	19–48.5	(496–466.5)	NA	NA	NA	< 100	**466**	**754**	**900**
10/27/2004	RW–2 (102.5–132.5')	102.5–132	(410.5–381)	NA	NA	NA	< 100	**1540**	**1140**	**2370**
10/27/2004	RW–2 (161.0'–190.5')	161–190.5	(352–322.5)	NA	NA	NA	260 CJ	**25300**	**1600**	**18900**
10/27/2004	REF102704	278–307.5	(235–205.5)	NA	NA	NA	168 CJ	**4220**	**1400**	**3450**
10/27/2004	RW–2 (278'–307.5')	278–307.5	(235–205.5)	NA	NA	NA	168 CJ	**3270**	**1310**	**3290**
10/28/2004	RW–2 (441–470.5')	441–470.5	(72–42.5)	NA	NA	NA	200	**2020**	**1830**	**2700**
10/4/2006	RW2–(19–49)	19–49	(496–466)	119000	< 5000	119000	< 67	**630**	**591**	**630**
10/4/2006	RW2–(102–132)	102–132	(411–381)	170000	< 5000	170000	**303**	**1260**	**619**	**1610**
10/6/2006	RW–2 (278–308)	278–308	(235–205)	198000	< 5000	199000	163	**971**	**517**	**1060**
4/10/2007	RW–2(19–49)(041007)	19–49	(496–465)	89200	< 5000	89300	205	**4580**	**616**	**843**
4/10/2007	RW–2(102–133)(041007)	102–133	(411–380)	124000	< 5000	124000	216	**7880**	**298**	**2590**
4/16/2007	RW–2(278–309)	278–309	(235–204)	126000	< 5000	126000	179	**4690**	**453**	**1290**
4/17/2007	RW–2(278–309)(041707)	278–309	(235–204)	126000	< 5000	127000	55.4 B	**1740**	**311**	**1350**
4/17/2007	RW–2(441–472) (4/17/2007)	441–471	(72–42)	141000	< 5000	141000	< 25	**2170**	**201**	**1150**
10/15/2007	RW2(19–50)	19–50	(496–465)	206000	< 5000	206000	< 6.3	**511**	**697**	**718**
10/15/2007	RW2(102–133)	102–133	(411–380)	134000	< 5000	134000	18.2 B	**616**	**345**	**381**
10/16/2007	RW2(161–192)	161–192	(352–321)	299000	53200	299000	16.5 BJ	**653 J**	**1230 J**	**1510 J**
10/16/2007	RW2(278–309)	278–309	(235–204)	140000	54700	140000	22.5 BJ	**1680 J**	**1040 J**	**1790 J**
10/17/2007	RW2(441–472)	441–472	(72–41)	74400	< 5000	187000	34.0 BJ	**1140 J**	**1120 J**	**1510 J**
5/7/2008	RW–2(19–50) (5/7/2008)	19–50	(495–465)	75400	< 5000	75500	37.1 B	**2710**	**275**	**369**
5/7/2008	RW–2(103–133) (5/7/2008)	103–133	(410–380)	89900	< 5000	89900	19.3 B	**655**	**164**	**442**
5/5/2008	RW–2 (442–472)	442–472	(71–41)	NA	NA	NA	< 9.7 B	**2150**	< 0.18 B	**1570**
9/11/2008	RW–2(279–309) (9/11/2008)	279–309	(234–204)	148000	< 5000	148000	< 17 J	**1300 J**	**226**	**980**
9/16/2008	RW2(20–50)	20–50	(494–464)	84800	< 5000	84800	24.7 B	< 100	**193**	**199**
9/17/2008	RW–2 (103–133)	103–133	(410–380)	99300	< 5000	99400	27.4 B	**349**	**188**	**215**
7/13/2009	RW–2(20–50) (7/10/2009)	20–50	(495–465)	NA	NA	88000	< 244	**3520**	**280 J**	**215 J**
7/13/2009	RW–2 (102–133) (7/13/2009)	102–133	(411–380)	NA	NA	114000	< 100	**4160**	**125**	**165**
7/13/2009	RW–2 (162–192)	162–192	(352–323)	NA	NA	121000	< 42	**4120**	**160**	**303**
7/13/2009	RW–2 (279–309) (7/13/2009)	279–309	(234–204)	NA	NA	131000	< 100	**1390**	**108**	**198**
7/14/2009	RW–2(441–472) (7/14/2009)	441–472	(71–41)	NA	NA	153000	< 42	**930**	**226**	**334**
10/26/2009	RW–2(20–50) (10/26/2009)	20–50	(495–465)	NA	NA	78500	< 12	**2230**	**63.3**	**101**
10/27/2009	RW–2(103–133)	103–133	(410–380)	NA	NA	87700	13.6 B	**1330**	48.7 J	**79.8 J**
10/27/2009	RW–2(162–192)	162–192	(351–321)	NA	NA	98600	44.8 B	**2700**	**84.8 J**	**240 J**
10/28/2009	RW–2(279–309)	279–309	(234–204)	NA	NA	92100	89.8 B	**1600**	**112 J**	**193 J**
10/28/2009	RW–2(441–472)	441–472	(72–41)	NA	NA	149000	92.5 J	**2990 J**	**554**	**962**
6/29/2010	RW–2(279–289)	279–289	(234–244)	NA	NA	195000	< 100	< 100	< 0.46	12.4 J
5/24/2011	RW–2(279–289)(052411)	279–289	(234–244)	NA	NA	475000	16.1	183	< 0.18	< 0.18
6/3/2011	RW–2(452–462)	452–462	(61–51)	NA	NA	261000	**392**	**625**	< 0.18	< 15
5/8/2012	RW–2(279–289)(050812)	279–289	(234–244)	< 5000	< 5000	157000	< 24	< 100	< 15	< 15
5/10/2012	RW–2(452–462)(051012)	452–462	(61–51)	NA	NA	85000	63.5 B	187	< 0.12	5.3 B
5/16/2012	RW–2(452–462)(051612)	452–462	(61–51)	< 5000	14900	197000	NA	NA	NA	NA

RW-8

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
7/21/2008	RW8(158–178)	158–178	(411–391)	104000	< 5000	105000	< 7.4	< 7.4	**61.6**	**65.8**
7/22/2008	RW8(199–219)	199–219	(370–350)	108000	< 5000	109000	370 B	**405**	**89.9**	**94.9**
7/31/2008	RW8(42–62)	42–62	(527–507)	114000	< 5000	114000	23.7 B	197	**72.3**	**75.4**
7/7/2009	RW–8(42–62) (7/7/2009)	42–62	(527–507)	NA	NA	63500	**653**	**1570 J**	**137**	**135**
7/7/2009	RW–8(158–178) (7/7/2009)	158–178	(411–391)	NA	NA	192000	122	**759 J**	**158**	**158**
7/7/2009	RW–8(199–219) (7/7/2009)	199–219	(370–350)	NA	NA	116000	< 100	**895 J**	**121**	**126**
11/4/2009	RW–8(42–62)	42–62	(527–507)	NA	NA	58700	**418**	**593**	**124**	**132**
11/4/2009	RW–8(158–178)	158–178	(411–391)	NA	NA	193000	20.7 J	**423**	**174**	**171**
11/4/2009	RW–8(199–219)	199–219	(370–350)	NA	NA	121000	56.6 J	**1350**	**175**	**172**
6/25/2010	RW–8(163–173) (6/25/2010)	163–173	(406–396)	NA	NA	NA	NA	**358**	NA	**219**
6/25/2010	RW–8(204–214) (6/25/2010)	204–214	(365–355)	NA	NA	NA	NA	**2220**	NA	**424**
5/31/2011	RW–8(163–173)(053111)	163–173	(406–396)	NA	NA	97700	57.3 B	153	37.0	36.8
6/1/2011	RW–8(204–214)(060111)	204–214	(365–355)	NA	NA	245000	NA	**2950**	NA	**442**
6/3/2012	RW–8(163–173)	163–173	(406–396)	97700	< 5000	99000	36.4 B	175 B	27.1	35.4

SC-02

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
5/5/2008	SC–2 (080505)	47–67	(515–495)	224000	< 5000	103000	< 213 B	**5240**	< 634 B	**658**
9/17/2008	SC–2 (080917)	47–67	(515–495)	173000	< 5000	173000	96.3 B	**8040**	**599**	**619**
2/30/2009	SC–2(080309)	47–67	(515–495)	NA	NA	203000	< 100	**551**	**183**	**227**
10/20/2009	SC–2(102009)	47–67	(515–495)	NA	NA	218000	**403**	**2690**	**409**	**400**
5/25/2010	SC–2(052510)	47–67	(515–495)	NA	NA	183000	< 100	**856**	**51.2 J**	**64.4 J**
5/16/2011	SC–2(051611)	47–67	(515–495)	NA	NA	215000	57.0 J	**14900**	15.7	**644 J**
4/19/2012	SC–2 (041912)	47–67	(515–495)	211000	< 5000	213000	< 24	**1660**	**129**	**219**
6/19/2012	SC–2	47–67	(515–495)	213000	< 5000	213000	**327**	**937**	38.6	**89.5**

SW-PMB-02

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
6/9/2011	SW–PMB–02 (6/9/2011)			NA	NA	NA	790	197		
5/1/2012	SW–PMB–02			102000	< 5000	102000	1290 J	286		

SW-07

Date	Sample ID	ftbgs	msl	Iron – Total	Manganese – Total
11/3/2004	SW-7			331 CJ	261 J

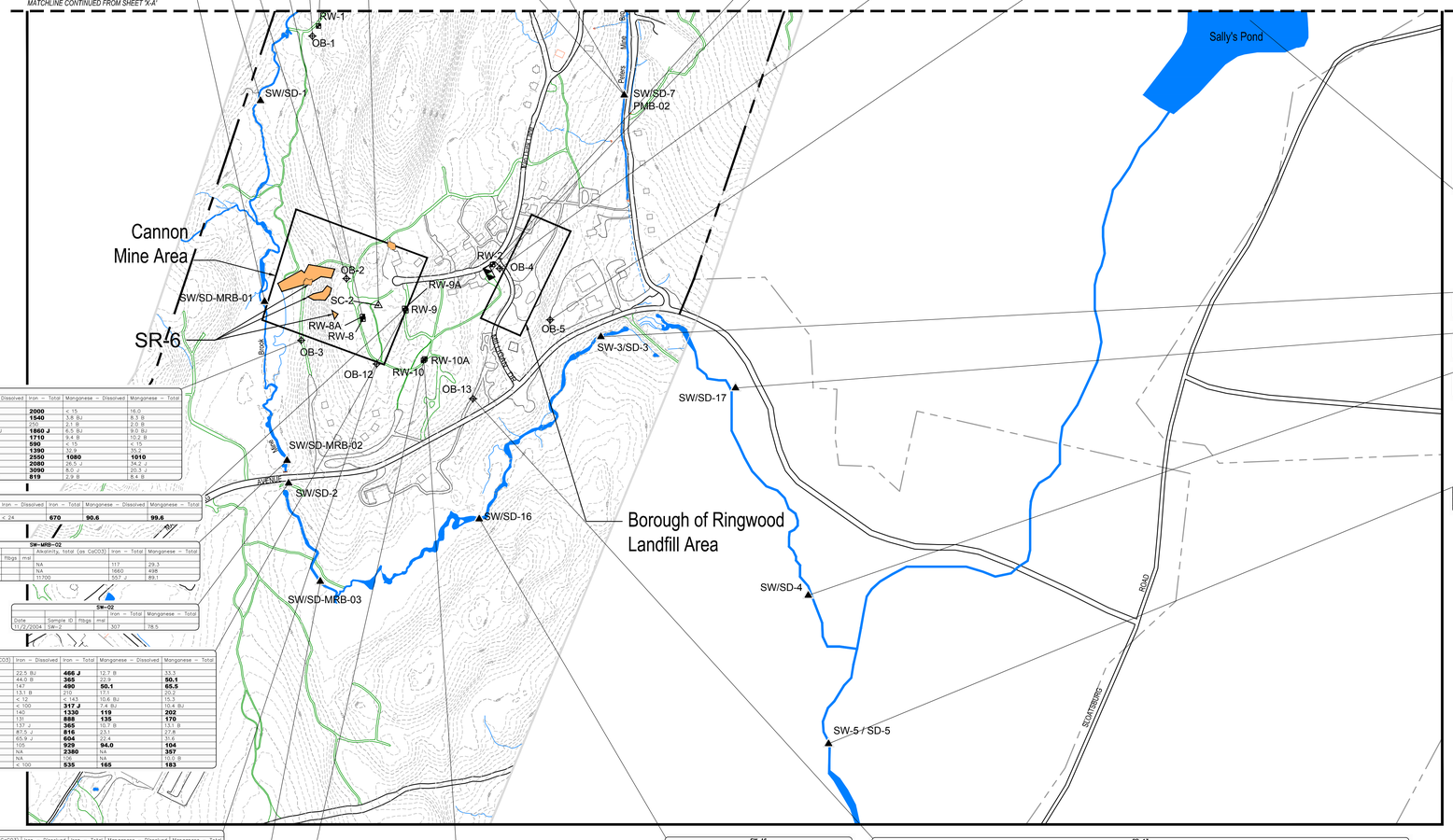
SW-01

Date	Sample ID	ftbgs	msl	Iron – Total	Manganese – Total
11/7/2004	SW-1 (101104)			265	< 15

SW-MRB-01

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Total	Manganese – Total
11/16/2005	SW–MRB–01 (11/16/2005)			NA	NA	NA	107	15.3
6/8/2011	SW–MRB–01 (6/8/2011)			NA	NA	NA	1620	59.3
5/2/2012	SW–MRB–01			40200	< 5000	40200	8050 J	3740

MATCHLINE CONTINUED FROM SHEET 'X-A'



OB-03

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
10/13/2004	OB–3 (10/13/04)	9–24	(487–472)	NA	NA	NA	< 100	**2000**	< 15	16.0
9/28/2006	OB–3	9–24	(487–472)	23100	< 5000	NA	81.1 B	**1540**	5.8 BJ	8.3 B
4/3/2007	OB–3(040307)	9–24	(487–472)	23500	< 5000	23500	96.0 B	210	2.1 B	2.0 B
10/8/2007	OB–3(071008)	9–24	(487–472)	52500	< 5000	52500	47.7 BJ	6.5 BJ	9.0 BJ	9.0 BJ
4/28/2008	OB–3(080428)	9–24	(487–472)	17200	< 5000	17200	91.1 B	**1710**	9.4 B	10.2 B
9/9/2008	OB–3(080909)	9–24	(487–472)	61600	< 5000	61600	< 7.4	**590**	< 15	< 15
6/30/2009	OB–3(063009)	9–24	(487–472)	NA	NA	48900	200	**1390**	3.0 B	15.7
10/20/2009	OB–3(102009)	9–24	(487–472)	NA	NA	49100	**632**	**2550**	**1080**	**1010**
5/25/2010	OB–3(052510)	9–24	(487–472)	NA	NA	63200	< 100	**2080**	26.5 J	34.2 J
5/17/2011	OB–3(051711)	9–24	(487–472)	NA	NA	56700	46.6 J	**3090**	8.0 J	20.3 J
4/23/2012	OB–3(042312)	9–24	(487–472)	46600	< 5000	46600	27.2 B	**819**	2.9 B	8.4 B

RW-9A

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
4/20/2012	RW–9A (85–95)(042012)	85–95	(475–465)	10900	< 5000	128000	< 24	**670**	**90.6**	**99.6**

SW-MRB-02

Date	Sample ID	ftbgs	msl	Alkalinity, total (as CaCO3)	Iron – Total	Manganese – Total
11/15/2005	SW–MRB–02 (11/15/2005)			NA	117	29.3
6/8/2011	SW–MRB–02 (6/8/2011)			NA	1660	498
5/1/2012	SW–MRB–02			11700	557 J	89.1

SW-02

Date	Sample ID	ftbgs	msl	Iron – Total	Manganese – Total
11/2/2004	SW–2			307	78.5

RW-9

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
7/23/2008	RW9 (80–100)	80–100	(480–460)	133000	< 5000	134000	22.5 BJ	**466 J**	12.7 B	33.3
7/23/2008	RW9 (134–154)	134–154	(426–406)	133000	< 5000	133000	44.0 B	**365**	22.9	**50.1**
7/24/2008	RW–9 (201–221)	201–221	(359–339)	130000	< 5000	130000	147	**490**	**50.1**	**65.5**
7/30/2008	RW9(20–40)	20–40	(540–520)	119000	< 5000	119000	13.1 B	210	17.1	20.3
7/15/2009	RW–9(20–40) (7/15/2009)	20–40	(540–520)	NA	NA	90300	< 12	< 143	10.6 BJ	15.3
7/15/2009	RW–9(80–100) (7/15/2009)	80–100	(480–460)	NA	NA	100000	< 100	**317 J**	7.4 BJ	10.4 BJ
7/16/2009	RW–9(134–154) (7/16/2009)	134–154	(426–406)	NA	NA	173000	140	**1330**	**119**	**202**
7/16/2009	RW–9(201–221) (7/16/2009)	201–221	(359–339)	NA	NA	178000	131	**888**	**135**	**170**
11/2/2009	RW–9(20–40)	20–40	(540–520)	NA	NA	70200	137 J	**365**	10.7 B	13.1 B
11/2/2009	RW–9(80–100)	80–100	(480–460)	NA	NA	174000	87.5 J	**816**	23.1	27.8
11/2/2009	RW–9(134–154)	134–154	(426–406)	NA	NA	179000	65.9 J	**604**	22.4	31.1
11/2/2009	RW–9(201–221)	201–221	(359–339)	NA	NA	179000	105	**929**	**94.0**	**104**
6/28/2010	RW–9(206–216)	206–216	(354–344)	NA	NA	NA	NA	**2380**	NA	**357**
5/27/2011	RW–9(206–216)(052711)	206–216	(354–344)	NA	NA	127000	NA	136	NA	10.0 B
4/20/2012	RW–9 (206–216)(042012)	206–216	(354–344)	22400	< 5000	271000	< 100	**535**	**165**	**183**

OB-12

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
11/7/2004	OB–12 (110704)	9–40	(549–518)	NA	NA	NA	< 100	< 100	< 15	< 15
12/30/2004	OB–12(123004)	9–40	(549–518)	NA	NA	NA	< 100	< 100	< 15	< 15
9/28/2006	OB–12	9–40	(549–518)	18300	< 5000	NA	< 67	104	2.4 BJ	2.4 BJ
4/3/2007	OB–12(040307)	9–40	(549–518)	13200	< 5000	13200	< 25	< 25	1.4 B	1.3 B
10/8/2007	OB–12(071008)	9–40	(549–518)	24400	< 5000	24400	20.5 BJ	19.5 BJ	1.8 BJ	1.6 BJ
4/28/2008	OB–12(080428)	9–40	(549–518)	13000	< 5000	13000	12.0 B	67.4 B	1.3 B	3.9 B
9/9/2008	OB–12(080909)	9–40	(549–518)	24800	< 5000	24800	< 7.4	< 7.4	< 0.24	< 0.24
6/30/2009	OB–12(063009)	9–40	(549–518)	NA	NA	20400	< 100	< 100	< 15	2.5 BJ
10/20/2009	OB–12(102009)	9–40	(549–518)	NA	NA	36500	16.7 B	< 100	1.4 B	< 15
5/25/2010	OB–12(052510)	9–40	(549–518)	NA	NA	22300	< 100	< 100	1.9 BJ	1.6 BJ
5/17/2011	OB–12(051711)	9–40	(549–518)	NA	NA	16700	< 100	31.0 J	< 15	< 15 J
4/19/2012	OB–12 (041912)	9–40	(549–518)	NA	NA	47200	< 24	51.7 J	< 15	< 15

SW-MRB-03

Date	Sample ID	ftbgs	msl	Alkalinity, total (as CaCO3)	Iron – Total	Manganese – Total
11/15/2005	SW–MRB–03 (11/15/2005)			NA	< 100	16.6
6/8/2011	SW–MRB–03 (6/8/2011)			NA	1210	189
5/1/2012	SW–MRB–03			22100	441 J	49.8

RW-10

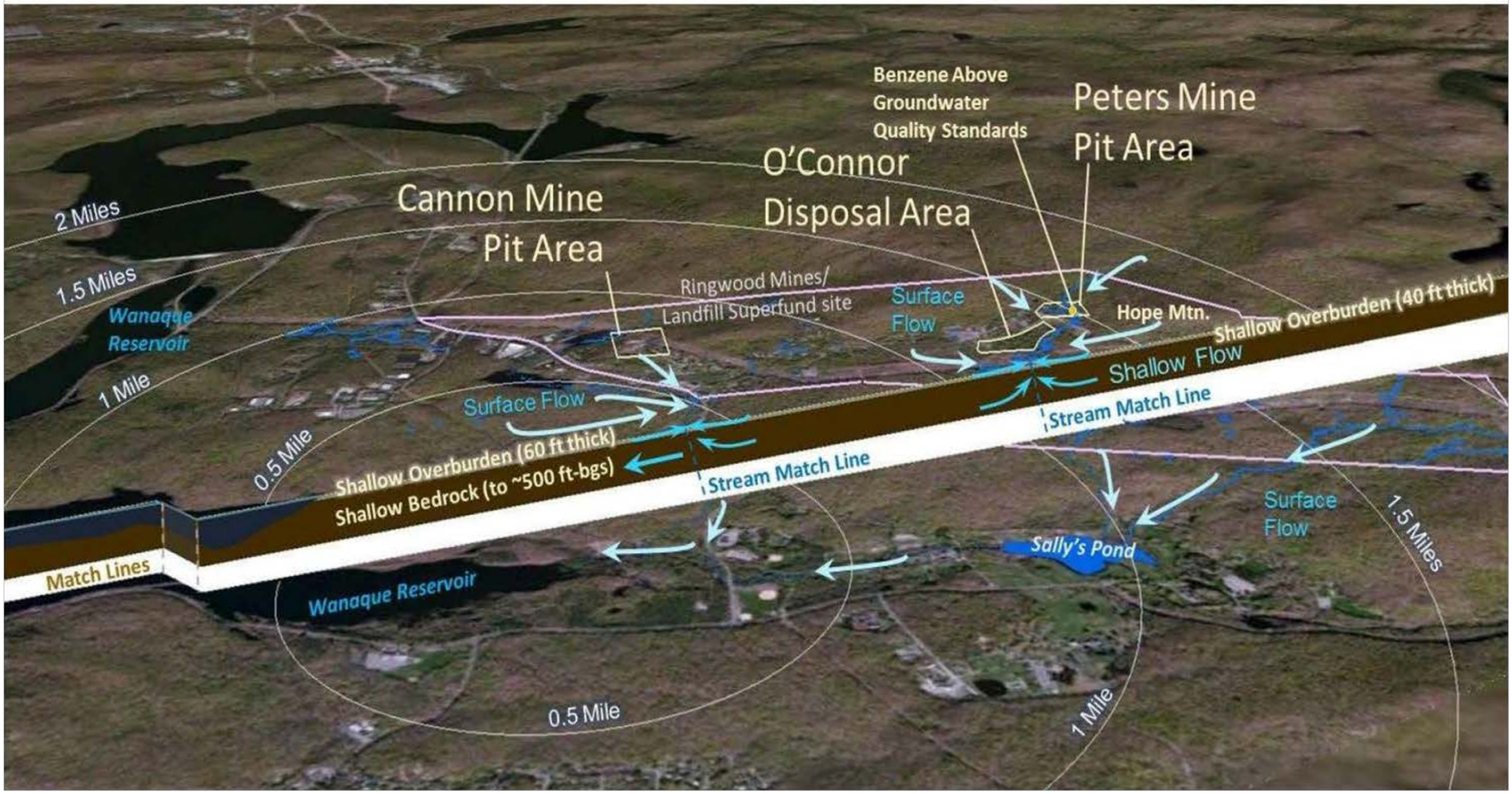
Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
7/25/2008	RW–10 (46–66)	46–66	(493–473)	65000	< 5000	65000	12.5 B	**435**	**70.4**	**76.0**
7/28/2008	RW10(70–90)	70–90	(469–449)	75700	< 5000	75700	15.6 B	**1270**	**159**	**174**
7/28/2008	RW10 (115–135)	115–135	(424–404)	80200	< 5000	80200	38.6 B	**1020**	**120**	**161**
7/29/2008	RW–10 (180–200)	180–200	(359–339)	79100	< 5000	79100	20.0 B	**1720**	**120**	**158**
7/8/2009	RW–10(22–42) (7/8/2009)	22–42	(469–449)	NA	NA	38400	< 100	259 J	13.3 B	11.8 B
7/9/2009	RW–10(46–66) (7/9/2009)	46–66	(493–473)	NA	NA	47200	< 100	**1090**	12.5 BJ	12.7 BJ
7/9/2009	RW–10(70–90) (7/9/2009)	70–90	(469–449)	NA	NA	44900	**524 J**	**1620**	17.8 J	16.9 J
7/9/2009	RW–10(115–135) (7/9/2009)	115–135	(424–404)	NA	NA	41400	253 J	**1540**	13.4 BJ	21.4 J
10/29/2009	RW–10(180–200) (7/9/2009)	180–200	(359–339)	NA	NA	161000	**409 J**	**1410**	**307**	16.8 J
10/29/2009	RW–10(22–42)	22–42	(469–449)	NA	NA	70900	**415 J**	**614**	13.6 B	15.0
10/29/2009	RW–10(46–66)	46–66	(493–473)	NA	NA	67600	**610 J**	**815**	11.8 J	13.2 B
10/29/2009	RW–10(70–90)	70–90	(469–449)	NA	NA	77400	**427 J**	**824**	13.0 J	14.4 B
10/29/2009	RW–10(115–135)	115–135	(424–404)	NA	NA	99200	**421 J**	**1050**	21.6	23.0
10/30/2009	RW–10(180–200)	180–200	(359–339)	NA	NA	155000	NA	**1990**	NA	**294**
10/30/2009	RW–10(180–200)MS	180–200	(359–339)	NA	NA	NA	**367 J**	NA	**295**	NA
6/9/2010	RW–10(185–195) (6/9/2010)	185–195	(354–344)	NA	NA	90500	59.6 B	72.0 B	< 0.46	< 0.46
6/25/2010	RW–10(120–130) (6/25/2010)	120–130	(419–409)	NA	NA	NA	NA	266	NA	< 0.46
6/25/2010	RW–10(185–195) (6/25/2010)	185–195	(354–344)	NA	NA	NA	NA	116	NA	< 0.46
6/28/2010	RW–10(185–195) (6/28/2010)	185–195	(354–344)	NA	NA	433000	94.0 J	NA	5.7 J	NA
5/31/2011	RW–10(120–130)(053111)	120–130	(419–409)	NA	NA	232000	NA	187	NA	< 0.18
5/31/2011	RW–10(185–195)(053111)	185–195	(354–344)	NA	NA	226000	57.0 B	132	< 0.18	0.32 J
6/1/2011	RW–10(120–130)(060111)	120–130	(419–409)	NA	NA	NA	156	NA	< 0.18	NA
4/18/2012	RW–10(185–195)(041812)	185–195	(354–344)	NA	NA	139000	< 24	< 24	< 0.12	< 0.12
4/19/2012	RW–10 (120–130)(041912)	120–130	(419–409)	NA	NA	191000	62.7 J	95.2 J	< 0.12	< 0.12
5/4/2012	RW–10(120–130)	120–130	(419–409)	< 5000	96200	210000	NA	NA	NA	NA
5/4/2012	RW–10(185–195)	185–195	(354–344)	< 5000	41000	141000	NA	NA	NA	NA

SW-16

Date	Sample ID	ftbgs	msl	Iron – Total	Manganese – Total
11/2/2004	SW–16			339	44.9

OB-13

Date	Sample ID	ftbgs	msl	Alkalinity, Bicarbonate	Alkalinity, Carbonate	Alkalinity, total (as CaCO3)	Iron – Dissolved	Iron – Total	Manganese – Dissolved	Manganese – Total
10/13/2004	OB–13 (10/13/04)	8–60	(491–439)	NA	NA	NA	< 100	< 100	< 15 J	< 15 J
10/3/2006	OB–13	8–60	(491–439)	29000	< 5000	29000	< 67



Ringwood Mines/Landfill Site
Ringwood, New Jersey
Site-Related Groundwater Remedial Investigation Report

Site-Wide Conceptual Site Model

ARCADIS

FIGURE
54

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