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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau Of District Mining Operations
Moshannon Office

AMD Treatment
Cambria District Mining Operations

Mining and Reclamation Advisory Board
Meeting of April 25, 2016

Flight 93 Pump Well Treatment System

“Engineered Wetlands” to Filter Iron and Manganese

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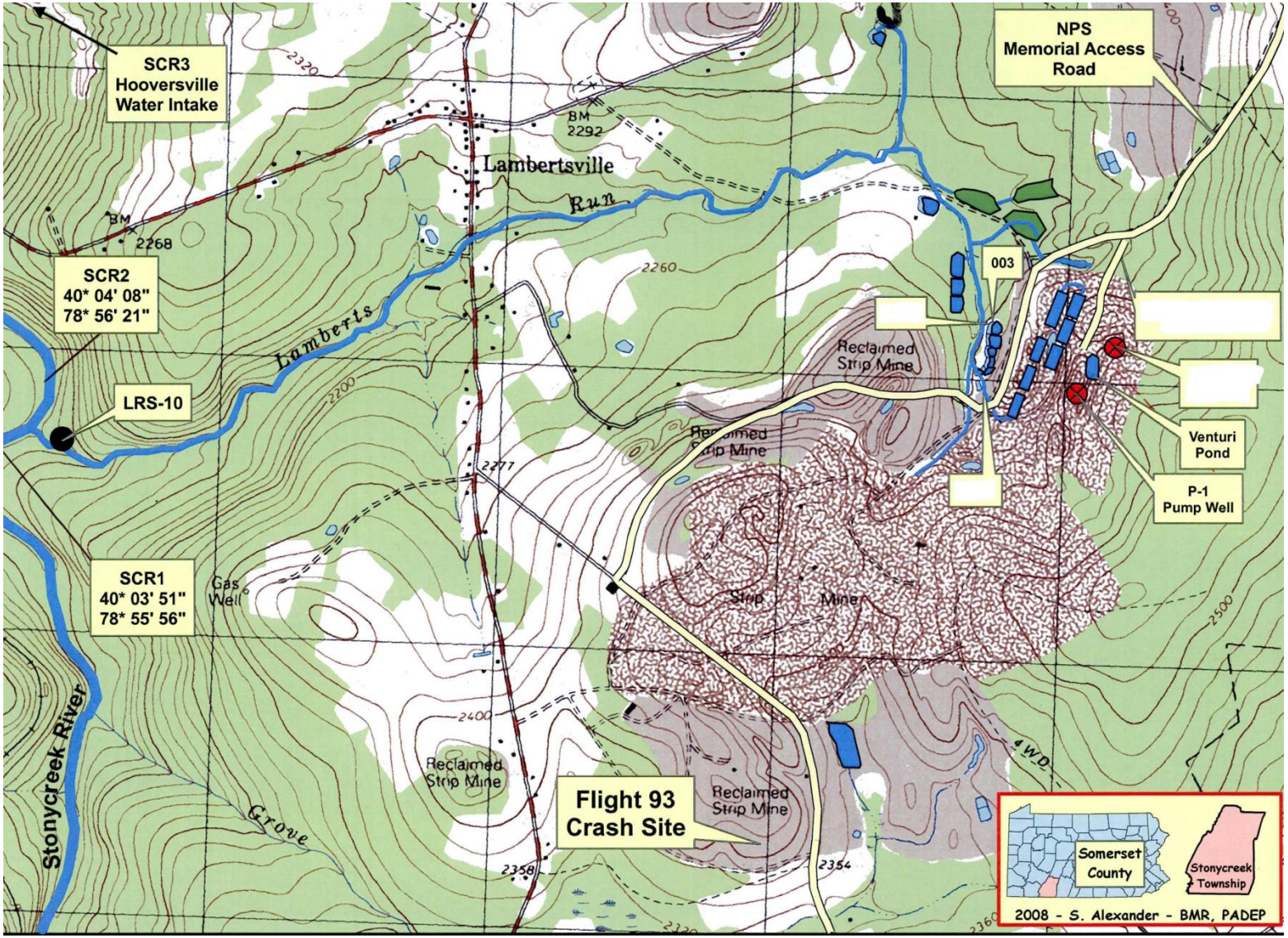
Site Map Flight 93 Pump Well



Flight 93 Pump Well Treatment System

- The Pump well produces 775 gpm that flows through a passive treatment system comprised of twelve pond units. Originally lime was applied to treat the high iron levels. Currently, No chemical treatment is used.

- The treatment process consists of oxidizing the 40 mg/l iron and then settling the iron precipitate, In addition, two treatment units oxidize the 10 mg/l manganese in both the wetland and in the Mn-bed

- The 1.5 acre “Engineered Wetland” is key to settling the “residual” iron and to oxidizing the manganese. The Mn-bed polishes the remaining manganese. These two additional treatment units were constructed with an OSM grant of $312,905

- The major operating cost is the electric bill of $56,000/yr. and the labor bill of $12,000/yr.

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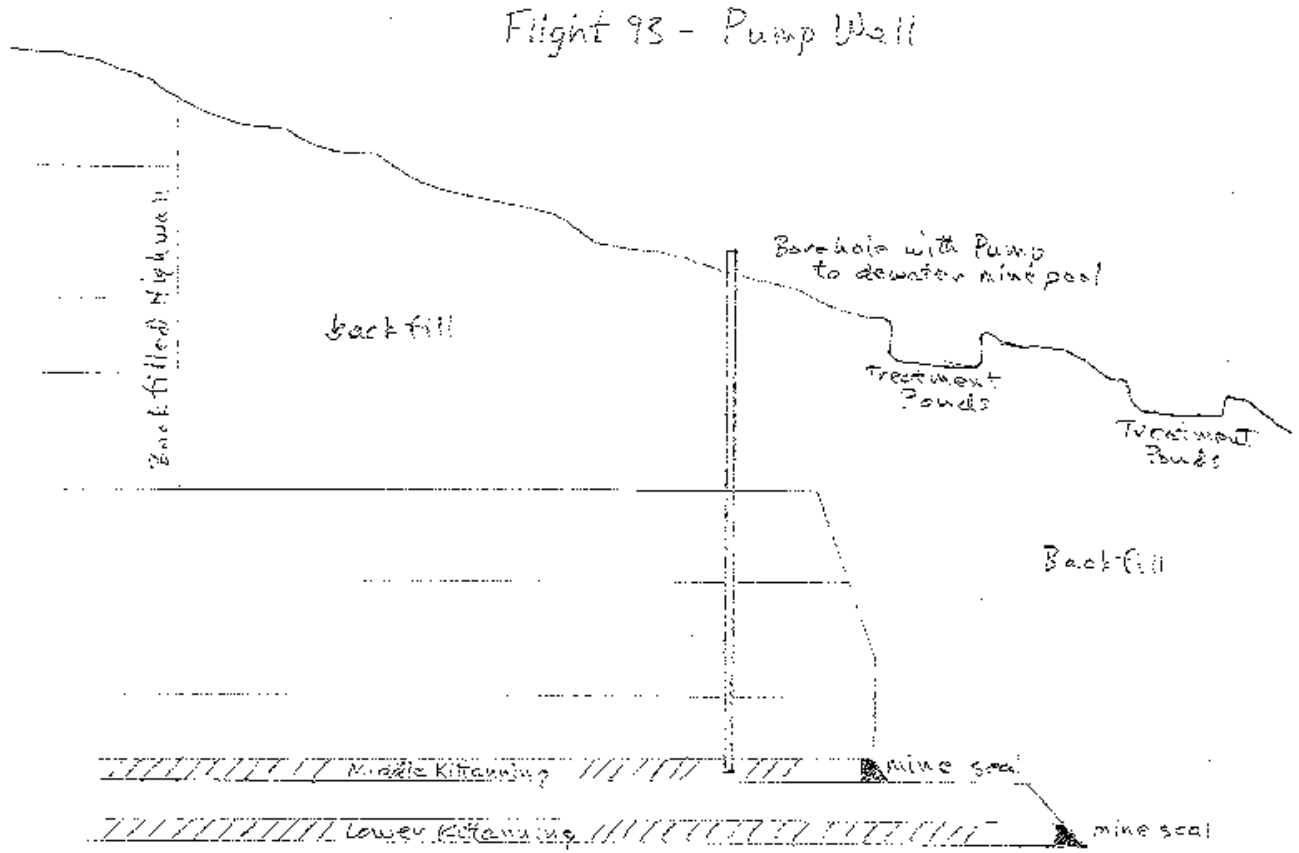
Flight 93 Pump Well Treatment System – Pine Glen



A Borehole was drilled into old mine workings and the mine pool dewatered in order to prevent a discharge near the Fl-93 Impact site

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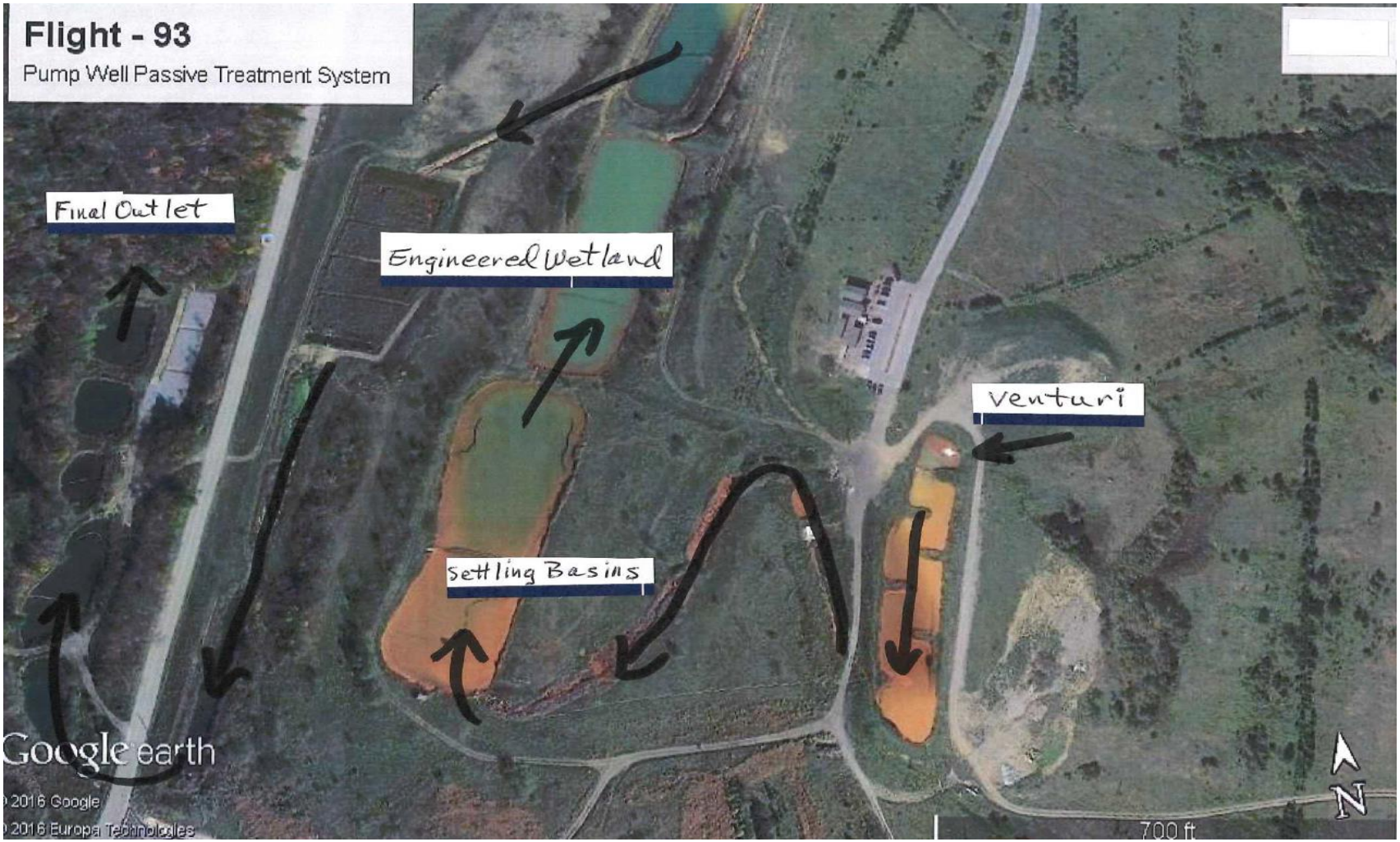
Key Components of Passive Treatment System



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Pump Well Treatment System – Raw Water

Deep mine water contains 40 mg/l

Flow	775	GPM
pH	6.8	
Alk	230	mg/l
FE	40	mg/l
Mn	10	mg/l

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Venturi Oxidizer at System Inlet

Four venturis add oxygen to the “reduced” well water in order to oxidize the ferrous iron Fe2+

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Large Settling Basins

Aeration ditch-line flows down to the series of large settling ponds with curtains

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Engineered Wetland

Engineered Wetland treats the residual iron and manganese

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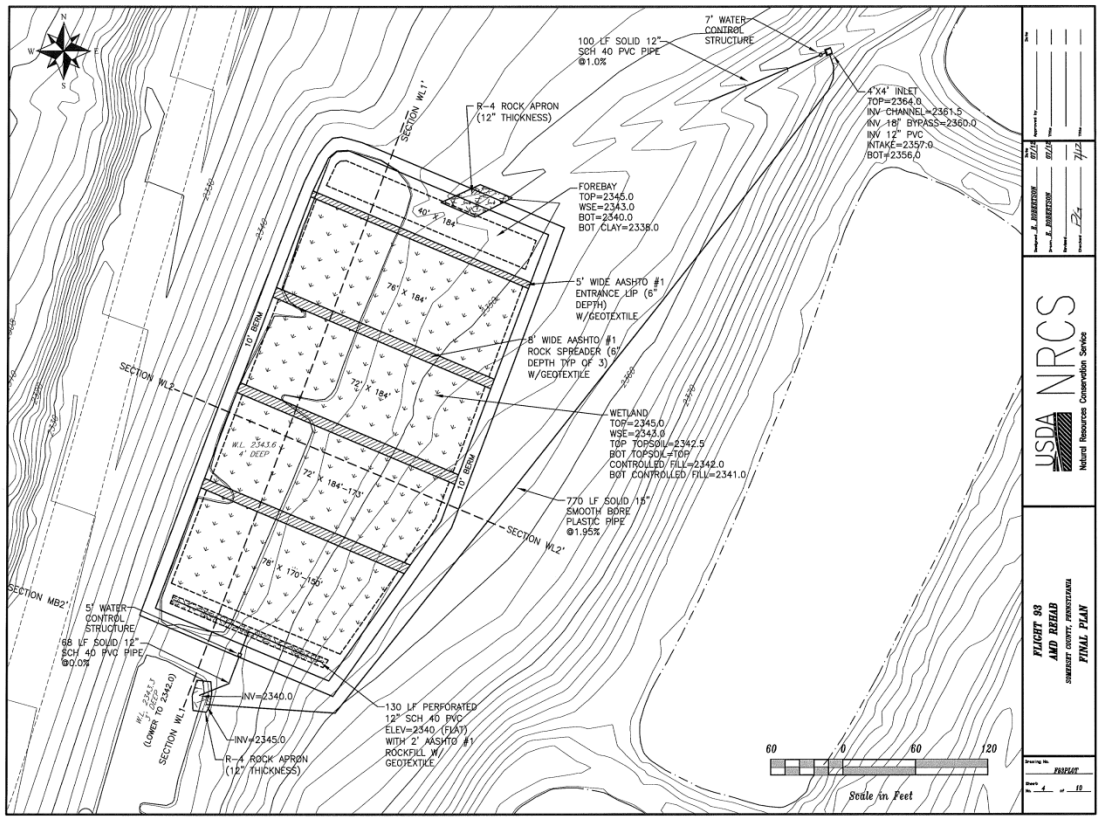
Design of Engineered Wetland



Forebay, outbay, and level lip spreaders:
spread the 775 gpm flow across 1.5 acre wetland

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Problems with Construction

Large width with a low edge allowed water to accumulate

Deeper water retarded vegetation growth in wetland

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Urinine Dye Test

Dye is added to the wetland inlet

Final Results: surprisingly good flow distribution across wetland due to the series of four level-lip rock spreaders

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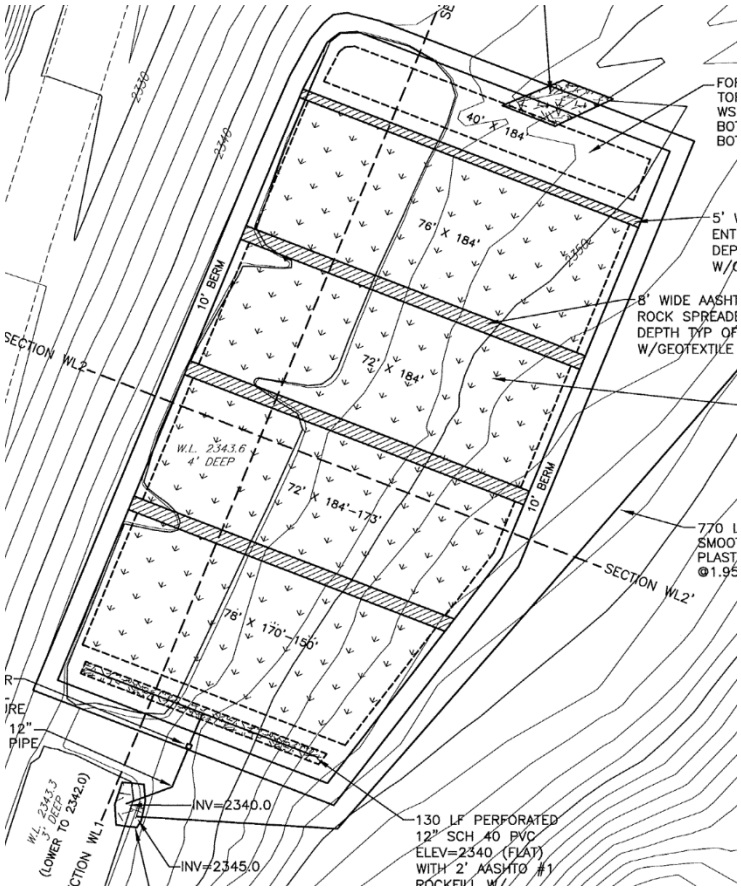
Performance of Engineered Wetland

	INLET	OUTLET
Flow	775 gpm	775 gpm
pH	8.0	7.6
Alk	170 mg/l	155 mg/l
FE	1.7 mg/l	0.4 mg/l
Mn	6.2 mg/l	1.4 mg/l

FE	76 %	removal
Mn	77 %	removal

In the past winters, the final outfall climbed up to 6 mg/l of iron due to poor cold weather settling.

After wetland installation the highest reading at the final outfall was 0.7 mg/l.



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Manganese - Bed

Treats the residual manganese at end of system

Series of trenches to spread out flow

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Final Outfall

Flow	775	GPM
pH	7.9	
Alk	145	mg/l
FE	0.2	mg/l
Mn	0.9	mg/l

Both iron and manganese are treated fully

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Flight 93 Pump Well Treatment System – Pine Glen

Color change through the system due to oxidation and settling of iron

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