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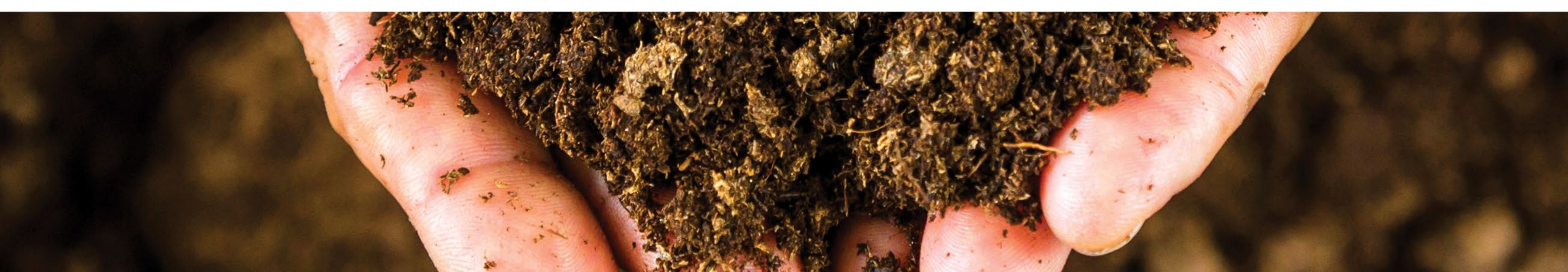
Coon Creek Watershed

DRAFT Plan-PEIS Meeting
January 18, 2024



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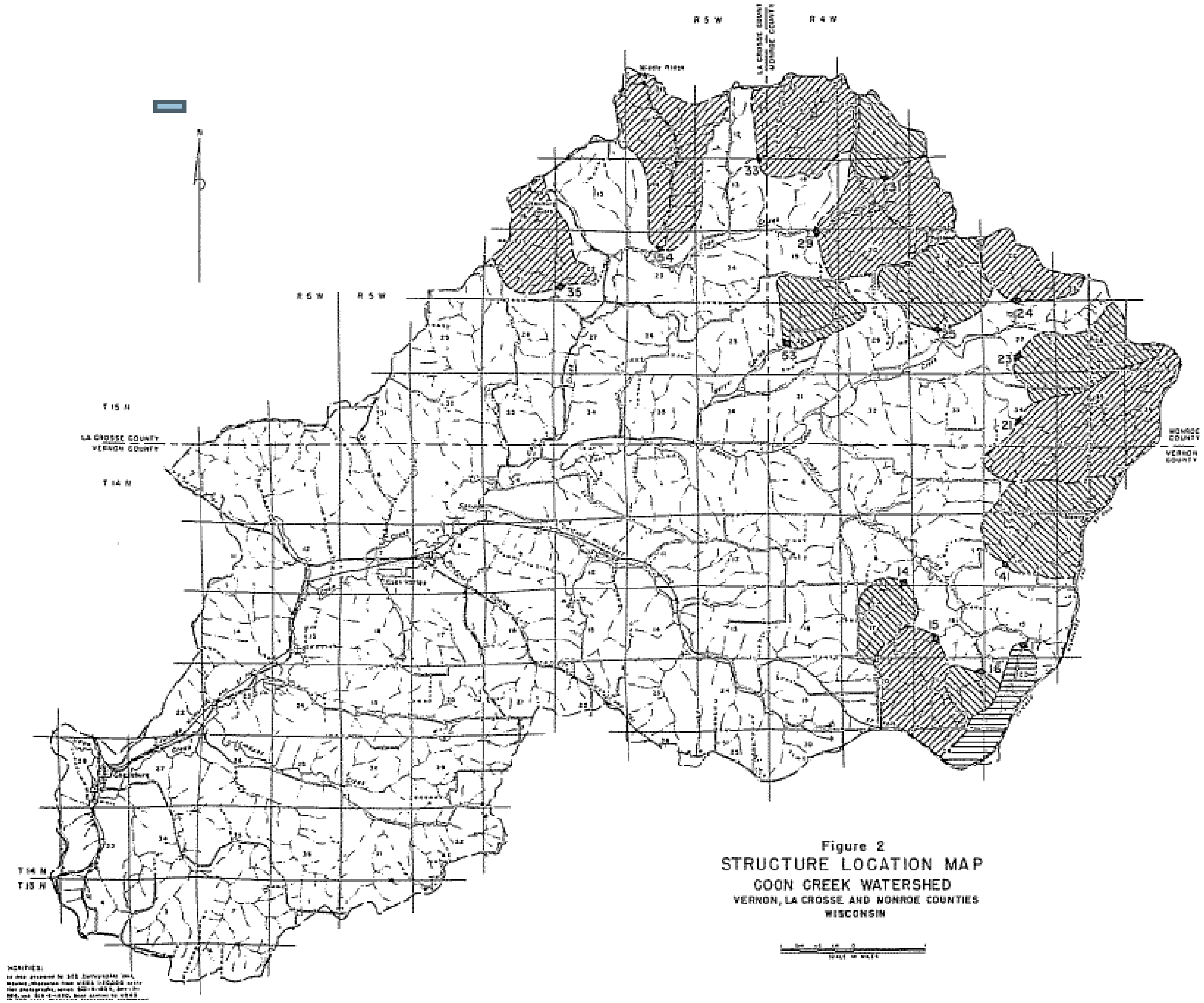
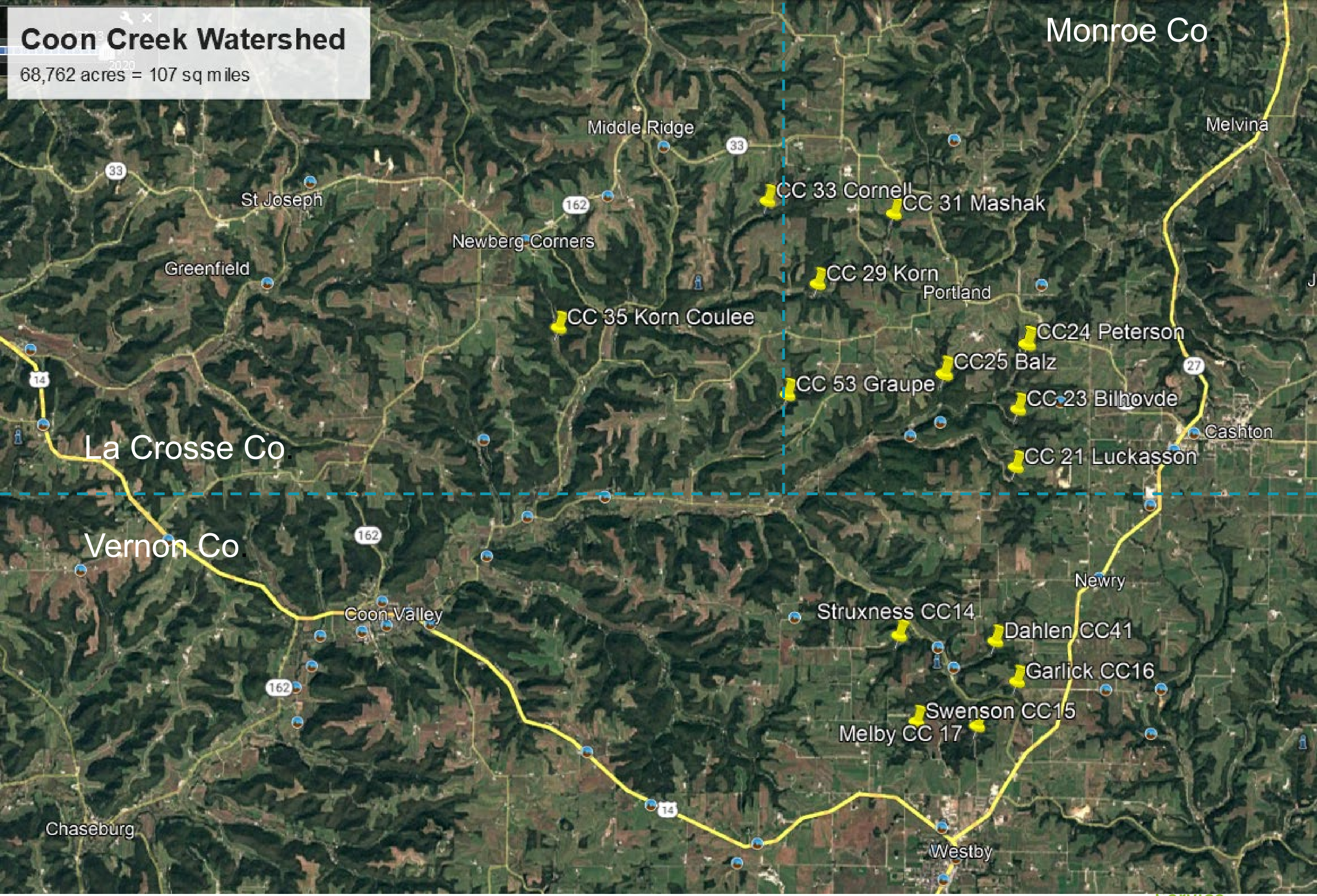
Soil Conservation Service, Demonstration Project 1933



68,762 ac = 107 sm

14 Flood Control Dams
control 27% of watershed

Original Work Plan 1958
Constructed



Service

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Flood Control Dams

Structure Name	Site Identification	Drainage Area (Acres)	Dam Height (Feet)	Top of Dam Storage Volume (ac-ft)	Wet or Dry Pool	Hazard Classification
Struxness	CC 14	422	28	56.0	Dry	Low
Swenson	CC 15	716	33	93	Dry	Low
Garlick	CC 16	223	25	27	Dry	Low
Melby	CC 17	789	26	58	Wet	High
Luckasson	CC 21	1988	30	209	Dry	Low
Bilhovde	CC 23	893	30	110	Dry	Low
Peterson	CC 24	527	30	60	Dry	Low
Baltz	CC 25	915	34	73	Dry	High
Korn	CC 29	1890	27	176	Dry	Low
Mashak	CC 31	373	33	49.3	Wet	Low
Korn Coulee	CC 33	1146	39	165	Dry	High
Cornell	CC 35	791	25	87	Dry	Low
Dahlen	CC 41	1499	35	178	Dry	High
Graupe	CC 53	669	36	101	Dry	Low

ac-ft = acre feet

Scope of Planning

Purpose for Planning

- Evaluate flood prevention measures in the Coon Creek watershed from Cashton to Chaseburg (68,762 ac).
- Determine measures eligible for Federal action through the NRCS Watershed Protection and Flood Prevention Operation program

Need for Planning

- Eliminate additional dam breaches after 3 failures in August 2018.

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CC 21 Luckasson Dam Failure – Monroe County

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CC 23 Bilhovde Dam Failure – Monroe County

CC 29 Korn Dam Failure – Monroe County

Preferred Alternative

Decommission all 14 dams in the watershed

- Excavate a notch in each dam to pass the 100-year flow
- Contour excavated spoil along residual embankment and valley walls
- Remove spillway pipes, risers, cantilever outlets, and plunge pools.
- Shape & seed all slopes to a stable and safe angle of repose
- Vegetate accumulated sediment pools and allow sediments to discharge over time with the geomorphic process.

Other Alternatives Evaluated

- **No Action** – Does not address failure modes that caused previous dam failures. Does not address DNR administrative order on failed dams.
- **Repair –** Does not address failure modes that caused failures.
- **Replacement** – Benefits do not exceed replacement costs $61M.
- **Rehabilitation** –Not much of the original dam would be left to meet current Federal and state standards.
- **Additional Dams** – Benefits of existing dams do not exceed replacement costs.
- **Land Management Changes** – Effective. Deferred to other USDA programs such as EQIP or RCPP
- **Replacement of large dams with multitude of smaller retention/farm ponds** – Effective. Deferred to other USDA programs such as EQIP or RCPP

Cost of Preferred Alternative

Construction Costs =	$3,798,100 (100% NRCS)
Engineering Fees =	$359,700 (100% NRCS)
Permitting =	$28,000 (100% Sponsor)
Admin Fees =	$173,300 (proportionate share)
Total =	$4,359,100
Federal share =	$4,270,400
County share =	$88,700

Geotechnical Investigation

Geologic stress fractures exist in sandstone foundation along the abutments and valley bottom.

Cracks create preferential seepage paths under and around the dam under full reservoir conditions. These cracks cause internal erosion which is primary mode of failure:

- erosion of fine-grained, embankment soil into open cracks in the bedrock;
- erosion of the soft, erodible bedrock itself;
- erosion of sand filling material within the bedrock cracks; and
- blowout of rock and soil overburden by increased hydrostatic pressure in open fractures.

Fractured sandstone abutments exposed after dam failure

Coon Creek dams were constructed prior to the Teton dam failure (1976) which greatly heightened awareness and understanding of internal erosion as a failure mode.

Geotechnical Investigation

Main Points

- Internal erosion may be going on for years without any visible signs of distress.
- Dams can fail suddenly by internal erosion after years of seemingly trouble-free performance.
- A failure mode may be in progress but may not have advanced to the point where it is visible.
- The dam may not have experienced the duration of a full reservoir to allow the failure mode to progress to the point of failure.

What's missing in CC dams?

Defense against internal erosion

- No deep cutoff into bedrock along abutments and valley bottom

  clay core trench, bentonite slurry trench, concrete secant walls
- No fractured rock treatments along the abutments

  dental grouting of the cracks
- No internal abutment drains

  several exterior, downstream drains has been added following seepage outbreaks
- No embankment drains

  filter diaphragms or chimney drains

Spillway stability and integrity

- No resistance to surface erosion and breach in the auxiliary spillways

  concrete cutoff walls or chute spillways

Auxiliary Spillway Integrity

= Resistance to breach

Remedies:

- concrete cutoff walls
- or concrete chute spillways

Remedies:

- Increased width
- Erosion resistant soils

Economics

Original Economic Analysis (1958 Work Plan)

Benefits needed to exceed costs over a 50-year period to justify Federal funding.
Federal interest or investment in the dams was completed in 2013.

Benefit - Cost Ratio = 1.2 : 1
($1.20 in benefits for every $1.00 spent on dam construction and maintenance)

Retrospective Economic Analysis

Actual Benefit - Cost Ratio = 0.9 : 1

$12.2M in benefits based on damages prevented
5 damage categories (land use, infrastructure, structures, crossings, and recreation) with 11 types of economic damage functions in each category.

$13.3M in construction and maintenance costs
5 categories (construction capital, overhead & labor, maintenance, oversight & inspections, opportunity cost of the lost reservoir area).

Retrospective Benefits

Table 1-4 Coon Creek Retrospective Protection Benefits Apportioned by Individual Dam

Coon Creek Watershed Dam #	Watershed Drainage acres	% of Total Protected Area %	Protection Benefits $1000's
14	421.92	3.3%	$400.9
15	716.36	5.6%	$680.6
16	223.33	1.7%	$212.2
17	789.18	6.1%	$749.8
21	1,988.29	15.5%	$1,889.1
23	893.81	7.0%	$849.2
24	526.58	4.1%	$500.3
25	914.78	7.1%	$869.1
29	1,889.59	14.7%	$1,795.3
31	373.39	2.9%	$354.8
33	1,146.14	8.9%	$1,089.0
35	790.57	6.2%	$751.1
41	1,499.31	11.7%	$1,424.5
53	669.12	5.2%	$635.7
WS Totals	12,842.37	100.0%	$12,201.6

Table 5-15 Storms Per Category 1960-2019

Event	Number of Storms
2-year	44
5-year	25
10-year	5
25-year	2
50-year	0
100-year	1
200-year	0
500-year	1

Projected Economic Analysis

Dam Replacement

Benefit - Cost Ratio = 0.1 : 1

$5.6M in benefits over 50 years $67.95M costs to replace and maintain 14 dams

- Original dam construction = $81K per dam in 1960s = $579K per dam in 2020
- Cost of dam construction to current standards = $4.2M per dam

Dam Decommissioning

Benefit-Cost Ratio = 0.06 : 1

$260K avoided maintenance over 50 years $4.4M decommissioning costs

- Benefits of avoiding a dam breach were not included in BCR due to the uncertainty in magnitude and timing.
- Decommissioning could result in $11.1M direct spending on goods and services in the three-county area, plus multiplier effect of re-spending in the county and region.

Hydraulic Impacts of Preferred Alternative

Table 3-9 Comparison of Flooded Acres Between Alternatives

Rainfall Event Recurrence	With Dams Area (acres)	Without Dams Area (acres)
5 year	1722	1781
10 year	1971	2061
25 year	2259	2404
50 year	2444	2533
100 year	2,705	2,933

Δ = 228 acres over 30 miles

Hydraulic Impacts of Preferred Alternative

Habitable structures anticipated to be inundated during the 100-year storm (7.4”) that would not be inundated with all dams functional.

- House, 113 North Main St. Chaseburg, Max depth 0.9 feet, Velocity 0.7 fps
- Business, 95 Central Ave, Coon Valley, Max depth 1.1 ft, Velocity 0.4 fps
- Business, 99 Central Ave, Coon Valley, Max depth 0.2 ft, Velocity 0.2 fps
- Garage with living space, 104 Central Ave, Coon Valley, Max depth 0.6 ft, Velocity 0 fps
- House, 103 Anderson St. Coon Valley, Max depth 1.3 ft, Velocity 0.0 fps
- House, 501 Mahlum St. Coon Valley, Max depth 1.5 ft, Velocity 2.1 fps

Hydraulic Impacts of Preferred Alternative

- 49 crossings would lose some protection if dams decommissioned.
- 8 public crossings would be flooded by a smaller storms

Table 3-27 Rain event required to produce flooding capable of flooding across bridge

Crossing Description	With Dams Event	With Dams Depth on Road	No Dams Event
County Road P (CC 14)	200-year	1.2 ft	100-year
Oakdale Avenue (CC 23)	>500-year	0 ft	200-year
Driveway Nashville/Mainstream/County Road Y (CC 31)	>500-year	0 ft	500-year
Mainstream/County Road Y and Natchez (CC 31)	500-year	1.3 ft	100-year
Muzenberger and Korn Coulee (CC 33)	>500-year	0 ft	500-year
Olstad Road (Timber Coulee)	50-year	1.5 ft	25-year
Highway 14/61 (Middle Coon Creek)	200-year	1.2 ft	100-year
Oakland Road/Rognstad Ridge Road (Timber Coulee)	50-year	1.5 ft	10-year

The most impacted crossings:

- Olstad Road and Oakland Road/Rognstad Ridge Road

Floodplain Management with Preferred Alternative

- FEMA 100-year floodplain does not account for the existence of 14 flood control dams. No adjustments required in the Base Flood Elevations.
- 10 of 14 dams have no floodplain mapping. Counties would adopt dams not-in-place zoning (no breach shadow zoning).
- CC 15, 16, 17, 41 are mapped in Special Flood Hazard Area - Zone A.
  - No detailed study was performed in these areas. DNR would expect a LOMR that shows dams removed from the map.
  - Zone A boundary would be adjusted on maps in the vicinity of the dams to reflect non-attenuation.
  - Completed map goes to FEMA. FEMA confirms with DNR. County adopts the FEMA LOMR with new maps into the county ordinance.
  - Estimated engineering costs would be roughly $8,000 FEMA fee plus $17,000 consultant fee, or $25K per dam. $100K total.

Cultural Resource Impacts of Preferred Alternative

Cultural resources investigation was conducted by the UW-Milwaukee Archeological Research Laboratory Center - Section 106 of the National Historic Preservation Act. 5-steps

1) Archival search to identify previously recorded archaeological and burial sites coincident with the project locations;
2) Archival search to identify previously surveyed architecture/history properties adjacent to the project locations;
3) Field survey of identified historic properties;
4) Archaeological field survey at each dam; and
5) Assessment of preferred alternative on identified resources.

Architectural History Summary

Dams of the Coon Creek Watershed project, individually and collectively as a discontiguous historic district, recommended not eligible for the National Register.

Three properties were identified as architecturally significant and recommended eligible for the National Register of Historic Places, but later determined outside the 100-year floodplain and breach shadows, with and without dams.

a. Skogdalen Church, Monroe County
b. Skogdalen Church Parish Hall, Vernon County
c. Edwin Sedevie Farmstead, La Crosse County

Snowflake Ski and Club, Vernon County, recommended eligible for the National Register based on its history, but not associations with significant persons or architecture.

Clubhouse, outbuildings, and golf course are currently in the FEMA 100-year floodplain and breach inundation area. The site will remain in the 100-year floodplain after dam decommissioning.

Archeology Summary

- A field investigation was conducted 1,000 downstream of each dam.
- No cultural material was encountered at 6 of 14 dam sites.
- Lithic scatter sites were identified at 5 of 14 dams but deemed not significant.
- Based on site integrity, potential to encounter subsurface cultural deposits, and density of cultural material, Phase II investigations are recommended at three sites: CC53 (Graupe) and CC25 (Baltz) and CC 21 (failed Luckasson dam).
- NRCS is in discussion with SHPO on the need for additional investigation or mitigation.
- The NRCS recommendation is to move forward with dam decommissioning without further investigation. Preferred alternative protects the sites.

Fish & Wildlife Impacts of Preferred Alternative

- No significant adverse effects to plants, animals, or habitat are anticipated with dam decommissioning.
- A site-specific inventory will be conducted prior to construction to inspect the dam and spoil areas for threatened, endangered, experimental or candidate species.
- Construction performed by DNR/USACE permit outside the fish spawning seasons.
- Average stream miles upstream of each dam = 3.0 miles (43 miles total)
- Planning area includes about 128 miles of streams; 87 miles of Class I-III trout waters.

Impacts of Sediment Release

- Sediment consumed about 52% of the planned storage capacity behind the dams
- Average sediment accumulation behind each dam = 11 acre-feet = 19K tons
- Phosphorous concentrations in the sediment pool (from two dam sites) ranged from 461 to 753 ppm (mg/kg) dry, and nitrogen concentrations ranged from 230 to 1,300 ppm dry.
- No pesticides or heavy metals

Impacts of Sediment Release

PFAS Analyte	WFK-4 0.5-1.5 ft	WFK-4 4-5 ft	WFK-1 0.5-1.5 ft	WFK-1 4-5 ft	CC-25 0.5-1.5 ft	CC-25 4-5 ft	CC-53 0.5-1.5 ft	CC-53 4-5 ft
N-EtFOSAA (ng/kg)	ND	**45**	ND	ND	ND	ND	ND	ND
PFBA (ng/kg)	ND	**53**	ND	ND	**93**	**83**	**150**	**170**
PFDoA (ng/kg)	ND	ND	ND	ND	ND	**42**	ND	ND
PFHpA (ng/kg)	ND	ND	ND	ND	ND	**39**	**48**	ND
PFNA (ng/kg)	ND	ND	ND	ND	**44**	**59**	**98**	**36**
PFOS-Total (ng/kg)	**52**	ND	ND	ND	**120**	**160**	**220**	**120**
PFPeA (ng/kg)	ND	ND	ND	ND	ND	ND	ND	**35**
PFTriA (ng/kg)	ND	ND	ND	ND	**39**	**37**	**41**	ND
PFUnA (ng/kg)	ND	ND	ND	ND	ND	**49**	**62**	ND

- Non-industrial contact limit for soils not exceeded < 1.26 ppm PFOS
- Industrial direct contact limit RCL not exceeded < 16.4 ppm PFOS
- No aquatic standards for PFAS
- No PFAS/PFOS limits for Federal action at present

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Breached dam shows channelization in the sediment pool

Breached dam shows channelization in the sediment pool

Estimated Sediment Release

Table 5-8 Estimated Sediment Contributed Per Year for the First 3 Years Post-Decommissioning

Structure	Sediment Contributed per Year for the First 3 Years following Decommissioning (tons)
CC 14	1,600
CC 15	1,200
CC 16	400
CC 17	1,400
CC 21	1,200
CC 23	1,400
CC 24	1,000
CC 25	1,400
CC 29	3,800
CC 31	1,900
CC 33	1,900
CC 35	1,100
CC 41	3,700
CC 53	1,000
Total	**23,000**

< dam breach volumes

Impacts of a Breach

Table 5-7 Amount of Earthfill Erosion from Dams CC 21, CC 23, and CC 29

Dam	CY Fill*
CC 21	28000
CC 23	14800
CC 29	16700

CY = cubic yard

Population at Risk of Breach

Coon Creek Watershed

Dam	NRCS Hazard Classification	NRCS Spreadsheet Computed PAR	Stream Miles in Breach Zone	Avg Daily Fishermen Seasonal	Total PAR
CC 14	Low	2	1.1	2	4
CC 15	Low	3	4.2	8	11
CC 16	Low	3	0.7	1	4
CC 17	High	8	4.2	8	16
CC 24	Low	0	5.0	9	9
CC 25	High	4	3.5	6	10
CC 31	Low	2	3.0	5	7
CC 33	High	14	5.1	9	23
CC 35	Low	2	3.6	7	9
CC 41	High	11	3.5	6	17
CC 53	Low	0	0.6	1	1
Totals		49		62	111

Population at Risk of Breach

Four of the remaining dams (CC-17, CC-25, CC-33, CC-41) are classified as “High Hazard” by the DNR due to the potential for loss of life in the case of a failure.

Breach inundation area:

- CC-17 contains a house, Westby Rod and Gun Club (banquet hall and campground), and the Snowflake Ski and Golf Club.
- CC-25 contains a seasonal cabin.
- CC-33 contains three houses and a park model trailer.
- CC-41 contains four houses and the Snowflake Ski and Golf Club.

➢ No habitable structures are located within the breach inundation area below the remaining “Low Hazard” dams.

➢ 58 farm service buildings would be at risk from a breach valued at $2M.

Alternatives to Large Dams
- Land management changes in upper watershed -

- Adoption of conservation practices on private lands is difficult to predict or maintain to increase infiltration and reduce runoff as an alternative to large flood control dams.
- Model was developed to represent the best possible conservation outcome in the watershed. Woodland was retained and 23,322 acres of cropland was converted to permanent, un-pastured grassland to increase infiltration and reduce runoff. (Runoff curve number reduction from 66 to 61)

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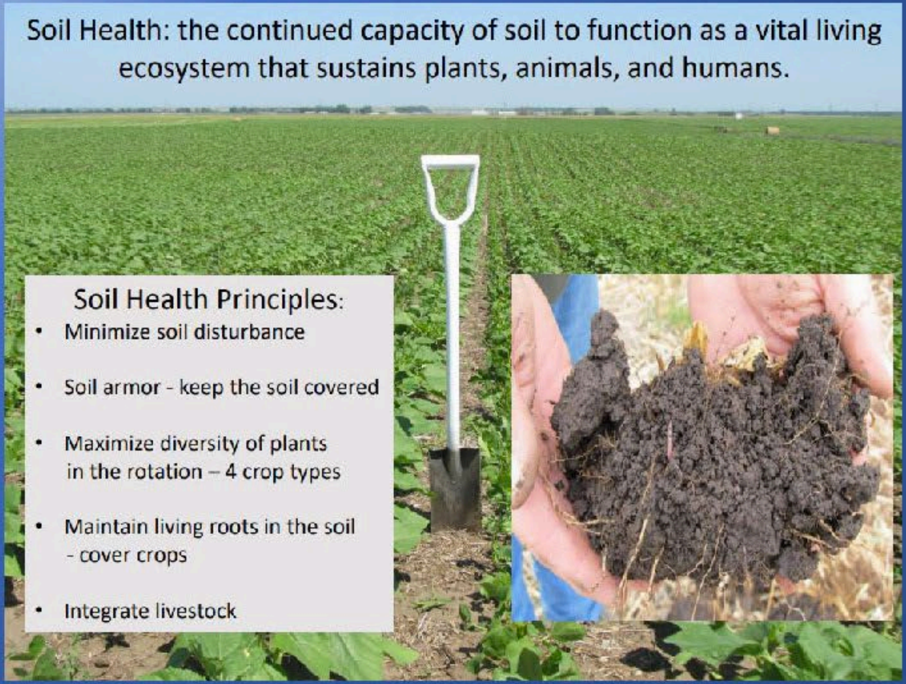
Land Management Changes

Does not address the final disposition of dams

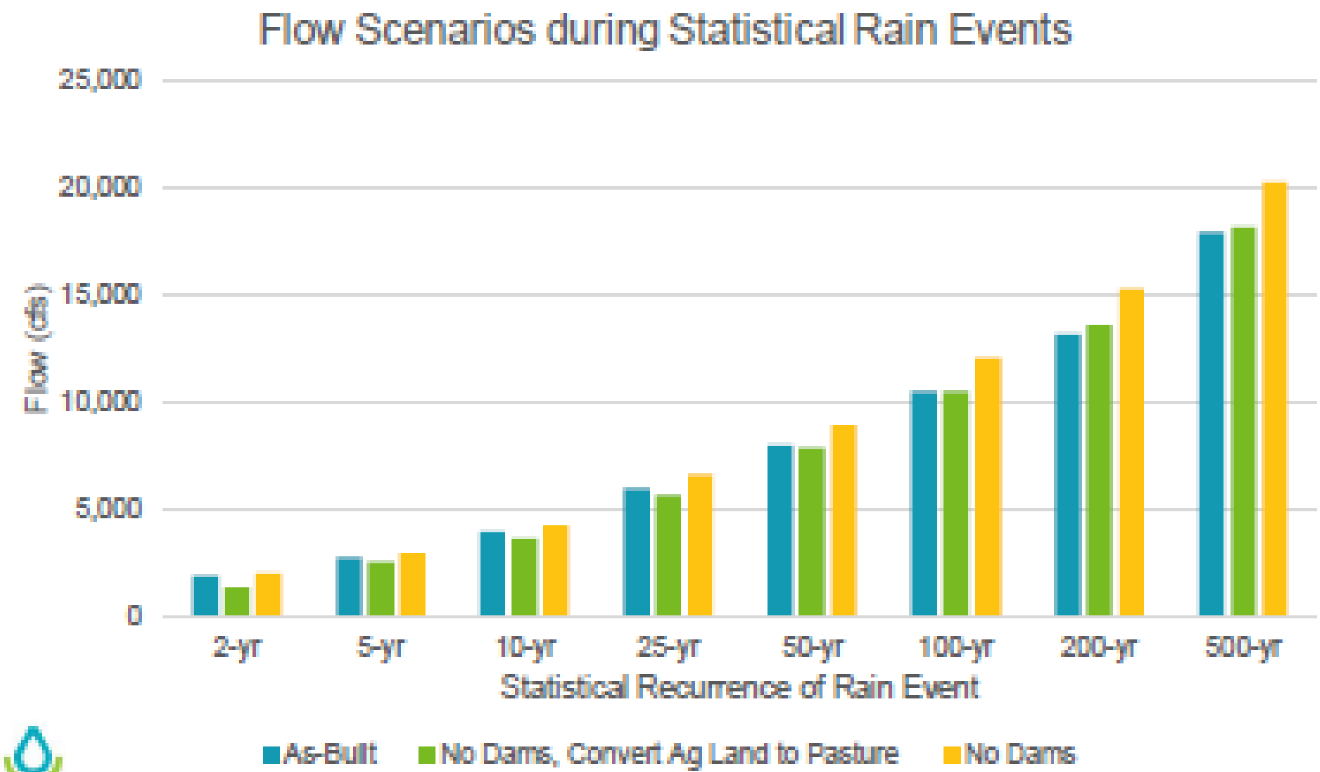
Conservation Practices

Maintain & Improve Land Use



Land Use Change Alternative

- **Peak Flow on Coon Creek at Coon Valley**



Land Use Changes Alternative

- Peak Depth on Coon Creek at Coon Valley (Hwy 14 Bridge)

	As-Built (ft)	No Dams, Convert Ag Land to Pasture (ft)	No Dams (ft)
2-yr	10.0	9.4	10.2
25-yr	12.9	12.8	13.3
100-yr	15.1	15.1	15.9

Land Use Change Alternative

- Peak Flow on Coon Creek at Coon Valley

	As-Built (cfs)	No Dams, Convert Ag Land to Pasture (cfs)	No Dams (cfs)
2-yr	1,923	1,364	2,067
5-yr	2,742	2,556	2,948
10-yr	3,944	3,664	4,278
25-yr	5,970	5,687	6,629
50-yr	7,996	7,896	8,973
100-yr	10,515	10,504	12,056
200-yr	13,186	13,634	15,295
500-yr	17,925	18,154	20,256

Alternatives to Large Dams

- Small Dams/Farm Ponds -

CC 21 Luckasson Subwatershed

- 11 Small Dams
- $650,000 Construction Cost
- Reduces the peak flow approximately 19% compared to CC 21 dam that reduces peak flow 55%

Floodplain – Land Use

Compensatory mitigation model for 50-years of lost flood protection:
$9,163/acre of cropland x 228 acres = $2M (costs less than a single dam)

Climate Change Considerations

Table 2: 24-hour duration IDF statistics generated using RainyDay SST software. Atlas 14 statistics for the same location (see Figure 1) are provided.

exceedance probability	Return Period	Atlas 14	lower bound	Mean	upper bound
[-]	[yrs]	[inches]	[inches]	[inches]	[inches]
0.5	2	2.7	2.8	2.9	3.0
0.2	5	3.5	4.0	4.1	4.2
0.1	10	4.3	4.8	5.0	5.2
0.04	25	5.4	5.8	6.2	6.5
0.02	50	6.5	6.7	7.1	7.6
0.01	100	7.6	7.5	8.2	9.1
0.005	200	8.9	8.4	9.4	10.5
0.002	500	10.8	9.3	11.1	13.0
0.001	1000	12.4	9.8	12.5	14.4

0.6” increase precip depths did not change economic outcomes of this study.