RAMSEY-WASHINGTON
METRO WATERSHED DISTRICT

Twin Lake Flood Risk Mitigation Feasibility Study

December 11, 2019

BARR

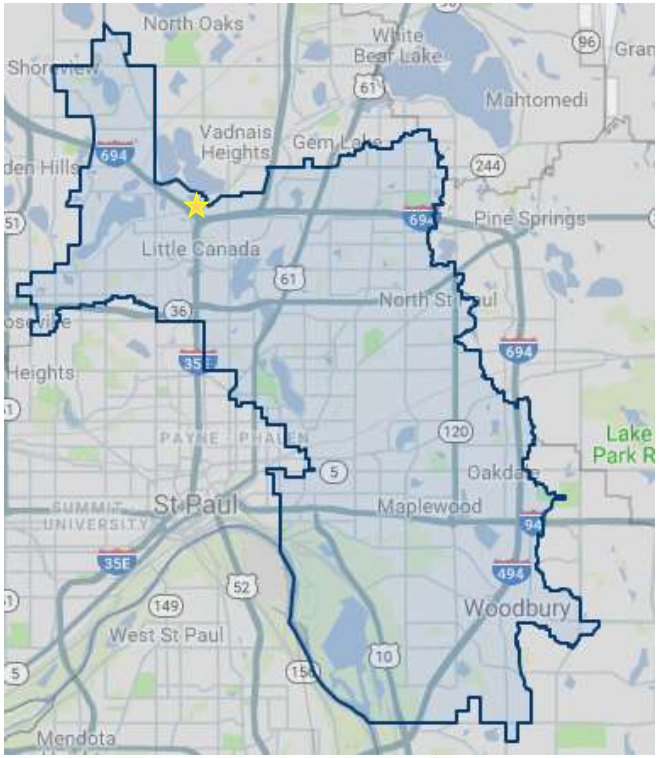
Feasibility Study Overview

- History of County Ditch 16
- Design criteria and flood-risk mitigation goals
- Alternatives evaluated
- Recommended Alternative

Question for the Board

Will Board authorize District and Barr staff to proceed with final design of Alternative 4 – a gravity outlet at 872.2? This would include

- Continued coordination with MnDOT and Little Canada
- Coordination with property owner
- Prepare final plans, specifications, and *operating plan*



Design Criteria & Flood-Risk Mitigation Goals

Design Criteria minimum requirements for system modifications

Flood-Risk Mitigation Goals objectives that go above and beyond

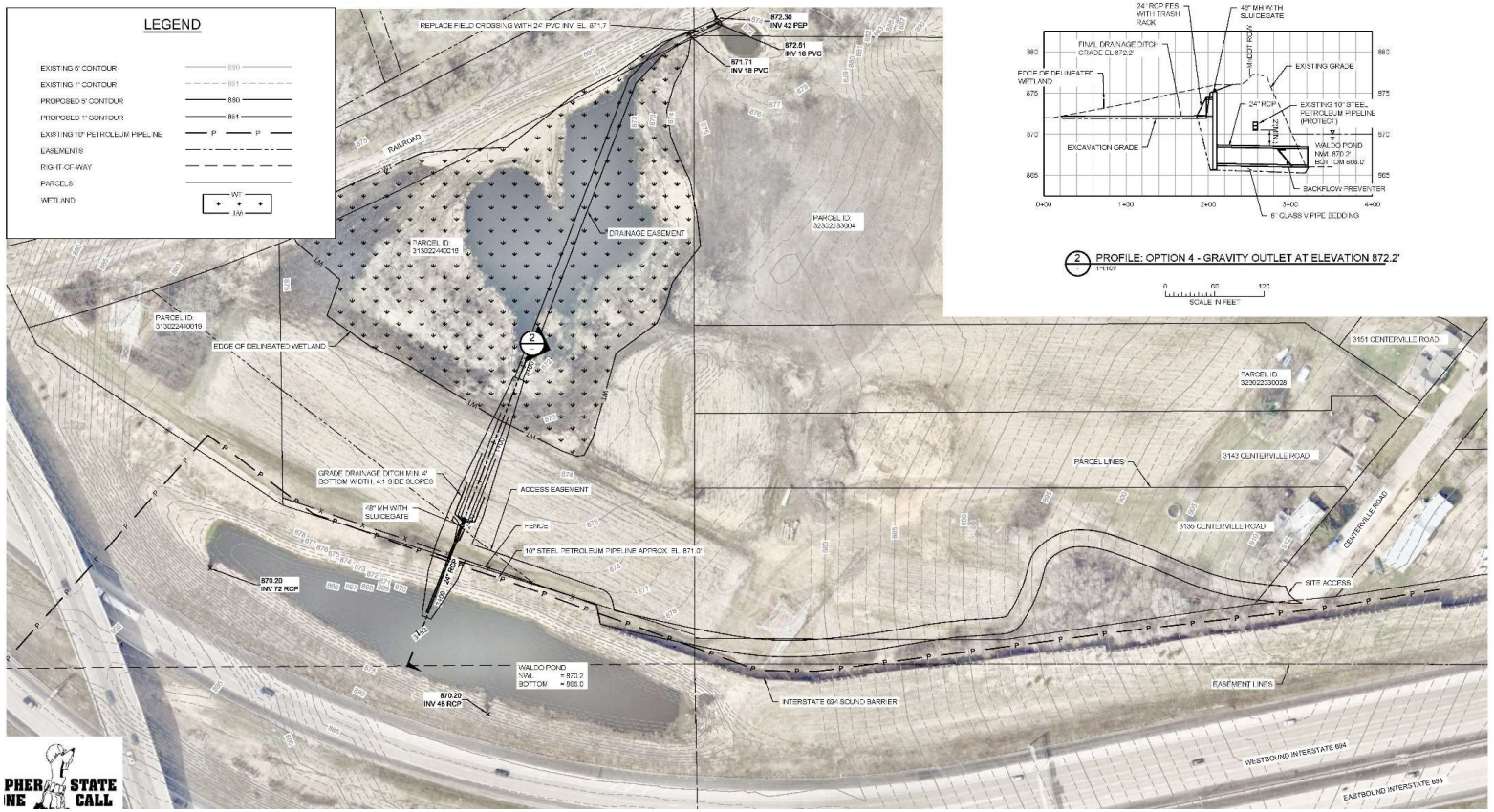
- Design Criteria
  - No increase in the 2-, 10-, or 100-year peak discharge
  - No increase in downstream flood elevations
  - Implement erosion and sediment controls
  - Avoid, minimize, and mitigate wetland impacts
  - Maintain minimum offset from petroleum pipeline
- Flood-Risk Mitigation Goals
  - Minimize frequency and duration of inundation
  - Maximize freeboard
  - Minimize upland impacts
  - Provide flexibility for future optimization

Flood-Risk Mitigation Alternatives

Alternative 4 is the recommended as the most feasible flood-risk mitigation alternative

- High-level screening
  - Lift station
  - Lowering embankment
  - Gravity outlet with no gate
- Feasibility Evaluation
  - Alternative 1: Remove Flood-Prone Structure
  - Alternative 2: Emergency Response Plan
  - Alternative 3: Gravity outlet at Elevation 874.0
  - **Alternative 4: Gravity outlet at Elevation 872.2**

Alternative 4: Gravity Outlet at 872.2



- Grade ditch to embankment
- Gravity pipe through embankment
- Gate
- Access & drainage easement acquisition
- Wetland mitigation
- Operation plan
- Estimated 30-year cost $214,000 – $401,000

Alternative Summary

	Alt 1: Remove flood-prone structure	Alt 2: Emergency Response Plan	Alt 3: Gravity outlet at 874.0	Alt 4: Gravity outlet at 872.2
No increase in peak runoff rate	✓	✓	✓	✓
No increase in downstream 100-year elevations	✓	✗	✗	✓
Implement erosion and sediment controls	✓	✓	✓	✓
Avoid, minimize, and mitigate wetland impacts	✓	✓	✓	✓
Petroleum pipeline offset	NA	✓	✓	✓
Maximize freeboard	✗	✓	✗	✓
Reduce inundation duration on residential property	✗	✗	✗	✓
Minimize upland impacts	✗	✓	✓	✓
Flexibility for future operation	✗	✗	✗	✓
Probable cost over 30-year period	$878,000 - $1,646,000 $1,097,000	$344,000 - $646,000 $430,000	$153,000 - $285,000 $190,000	$214,000 - $401,000 $267,000

*See feasibility study document for notes and assumptions related to this table.

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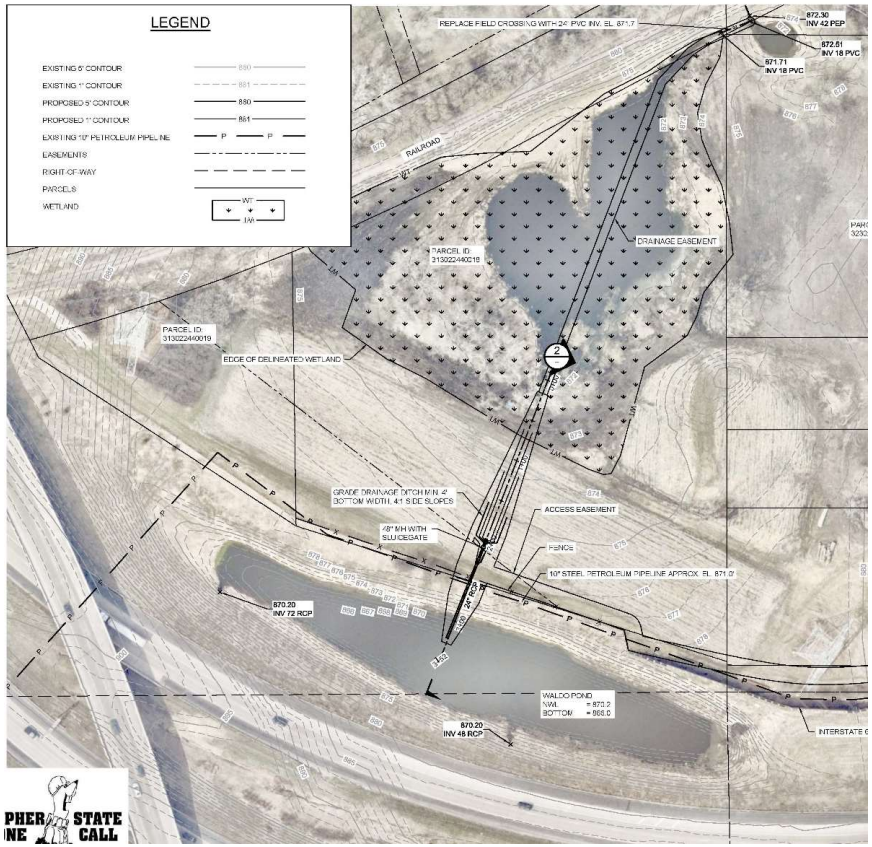
Twin Lake Flood-Risk Mitigation Feasibility Study



Question for board

- Will Board authorize District and Barr staff to proceed with final design of Alternative 4 – a gravity outlet at 872.2? This would include:
  - Continued coordination with MnDOT and Little Canada
  - Coordination with property owner
  - Prepare final plans, specifications, and *operating plan*

Design Criteria & Flood-Risk Mitigation Goals

Design Criteria minimum requirements for system modifications

Flood-Risk Mitigation Goals objectives that go above and beyond

- Design Criteria

Design Criteria	Permitting Authority
No increase in peak runoff rate during 2-year, 10-year, or 100-year event	RWMWD – Rule C MnDOT
No increase in downstream flood elevations	RWMWD – Rule D
Implement erosion and sediment controls	RWMWD – Rule E City of Little Canada – Fill Permit MPCA – NPDES Permit
Avoid, minimize, and mitigate wetland impacts	RWMWD – Rule F
Minimum 2-foot vertical offset from pipeline for pipes	BP
Minimum 4-foot vertical offset from pipeline for drainage ditches	BP
Pump or actively manage discharge	MDNR

- Flood-Risk Mitigation Goals

Design Goal	Notes
Maximize freeboard board between low home and 100-year water level.	Design goals are secondary objectives that a system modification should achieve after meeting the minimum design criteria summarized in Section 3.
Minimize the frequency and duration of inundation on residential property	
Minimize impacts to upland area	
Provide flexibility for future optimization	

Alternative Summary

	Alternative 1: Remove Flood-Prone Structure	Alternative 2: Emergency Response Plan	Alternative 3: Gravity Outlet at Elevation 874.0	Alternative 4: Gravity Outlet at Elevation 872.2
Design Criteria				
No increase in peak runoff rate during 2-year, 10-year, or 100-year event	✓	✓ See Note 1	✓ See Note 1	✓ See Note 1
No increase in downstream 100-year elevations	✓ See Note 2	✗ See Note 2	✗ See Note 2	✓ See Note 2
Implement erosion and sediment controls	✓	✓	✓	✓
Avoid, minimize, and mitigate wetland impacts	✓ No impacts	✓ No impacts	✓ No impacts. See Note 3	✓ See Note 3
Minimum 2-foot vertical offset from petroleum pipeline	NA	✓	✓	✓
Pump or actively manage discharge will require MDNR appropriation permit	NA	✓ See Note 4	✓ See Note 4	✓ See Note 4

Note(s):

(1) If operation plan is developed for when temporary pump can be operated or gate can be opened. There may be periods when the pump is turned off or gate is closed to avoid increases to the peak discharge rate.

(2) Discharging any additional flow downstream changes flood-risk. Alternative 1 is the only alternative that does not change downstream flood-risk. Alternatives 2 and 3 result in increases to the 100-year floodplain in the Phalen Chain and would require downstream modifications to mitigate impacts to the 100-year flood elevation. Alternative 4 includes an operating plan to reduce the potential to downstream impacts to the 100-year floodplain. Adherence to the operating plan that is consistent with permitting requirements and hydrologic modeling will reduce that risk.

(3) Wetland impacts must be minimized during final design. Alternative 3 and Alternative 4 may have opportunity for wetland enhancement and ecosystem restoration for a wetland adjacent to agricultural field.

(4) MDNR appropriation permit is required prior to activating Alternative 2 temporary pump. An appropriation permit may not be required for Alternative 3 if operable gates are removed from the design. A long-term appropriation permit may be obtained for permanent outlet included in Alternative 4.

	Alternative 1: Remove Flood-Prone Structure	Alternative 2: Emergency Response Plan	Alternative 3: Gravity Outlet at Elevation 874.0	Alternative 4: Gravity Outlet at Elevation 872.2
Flood-Risk Mitigation Goals				
Maximize freeboard between low home and 100-year water level	✗ See Note 5	✓	✗	✓
Minimize duration that inundation extends onto residential property	✗ See Note 6	✗ See Note 6	✗ See Note 6	✓
Minimize impacts to upland area	✗ See Note 7	✓	✓	✓
Provide flexibility for future optimization	✗ See Note 8	✗ See Note 8	✗ See Note 8	✓
Engineer's opinion of probable cost over a 30-year period	$878,000 - $1,646,000 $1,097,000	$344,000 - $646,000 $430,000	$153,000 - $285,000 $190,000	$214,000 - $401,000 $267,000

Note(s):

(5) Alternative 1 removes the low home.

(6) Alternative 1 does not reduce inundation duration. Alternative 2 only reduces the duration that inundation extends onto residential property when the water levels trigger implementation of emergency response measures. Alternative 3 does not reduce inundation duration for water levels below 874.0.

(7) Alternative 1 disturbs the most upland area, including relocation of existing home.

(8) Alternatives 1, 2, and 3 do not include permanent modifications that allow for flexibility to modify future management of lake levels. Alternative 4 would allow the outlet elevation to be increased in the future.

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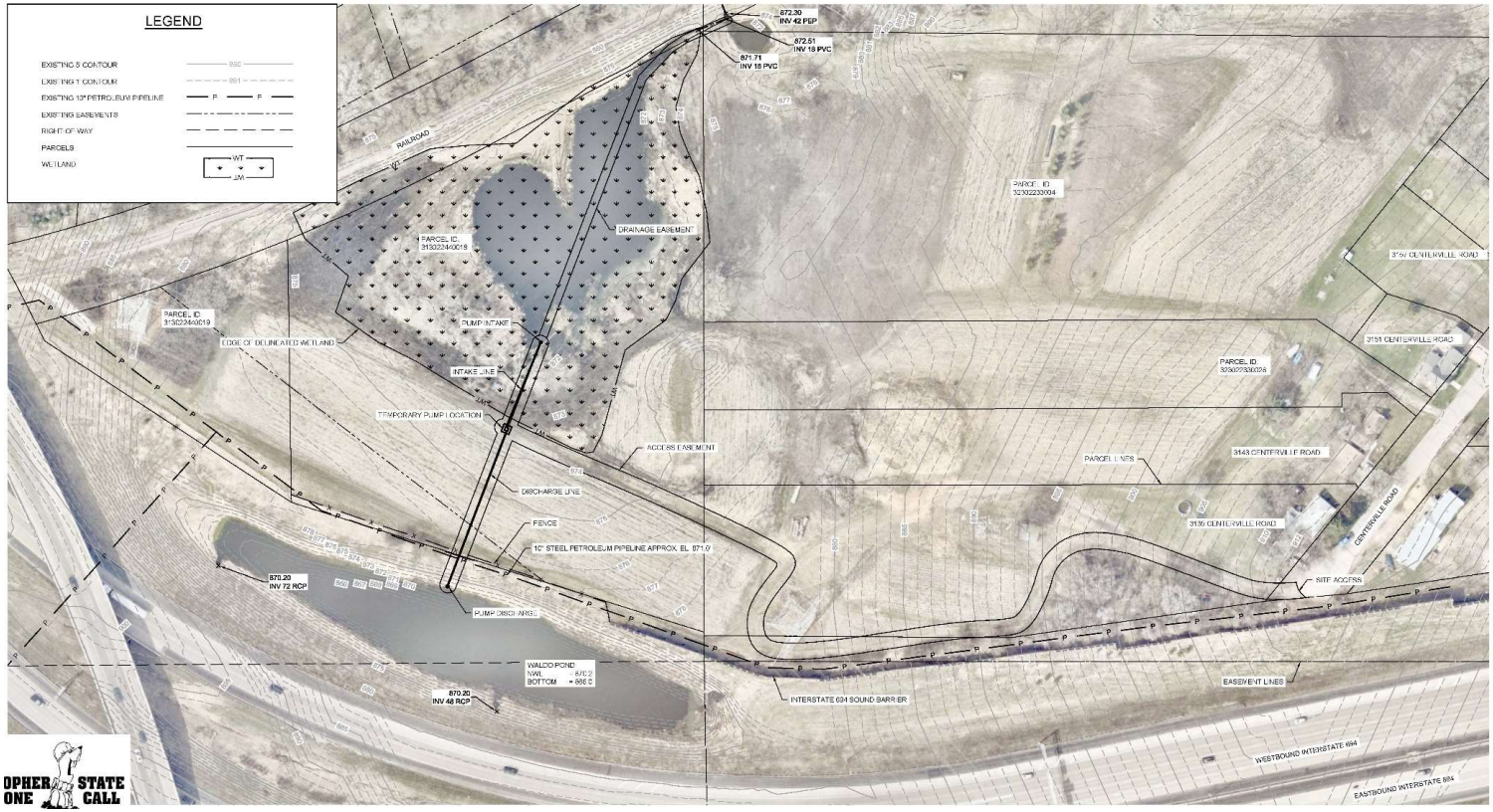
Alternative 1: Remove Flood-Prone Structure

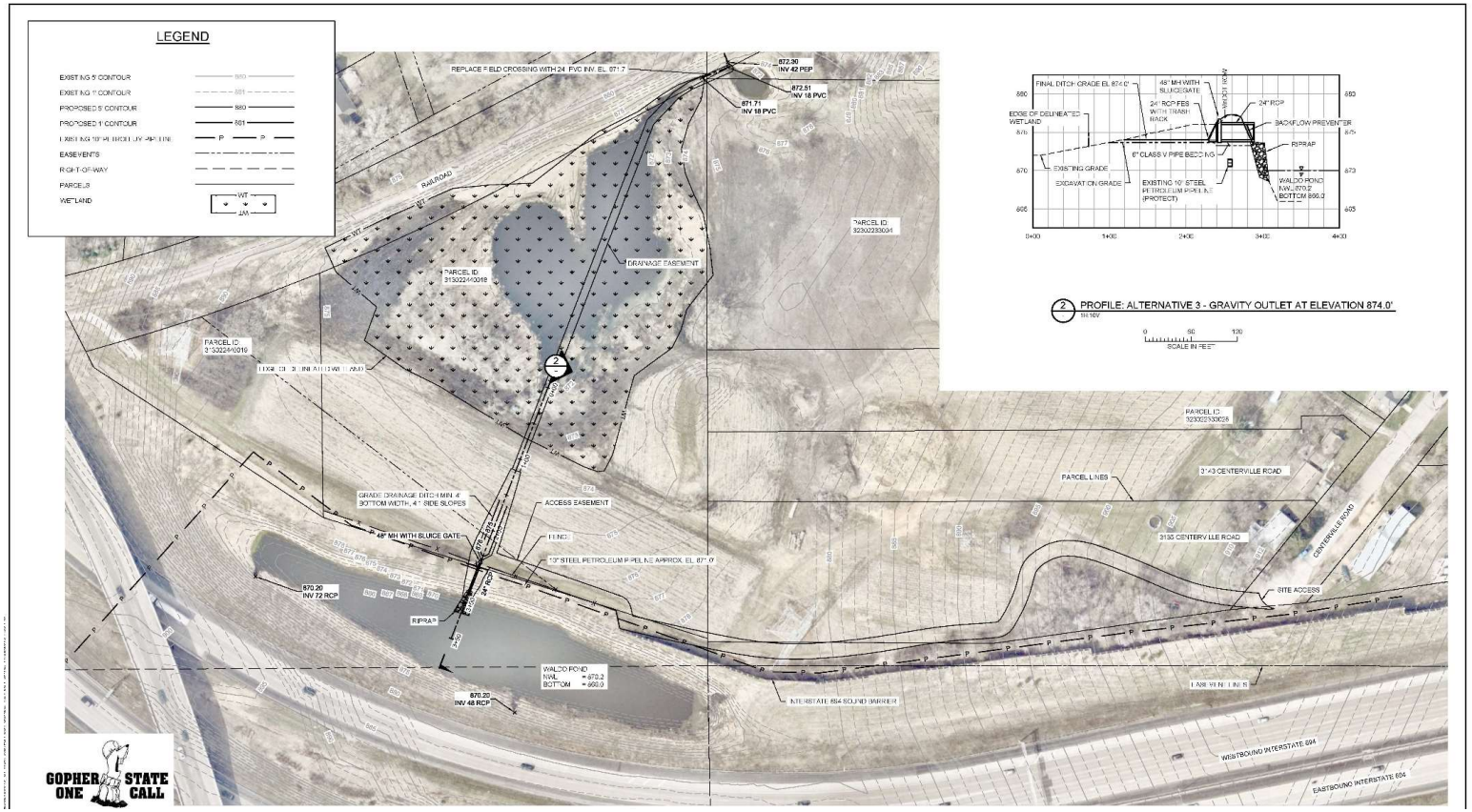
- Hazardous substance abatement
- Property acquisition
- Removal or relocation of structures
- Operation plan
- Estimated 30-year cost $848,000 – $1,646,000

Alternative 2: Emergency Response Plan



- Operation plan
- Coordination with City
- Access & easement acquisition
- Estimated 30-year cost $344,000 – $646,000

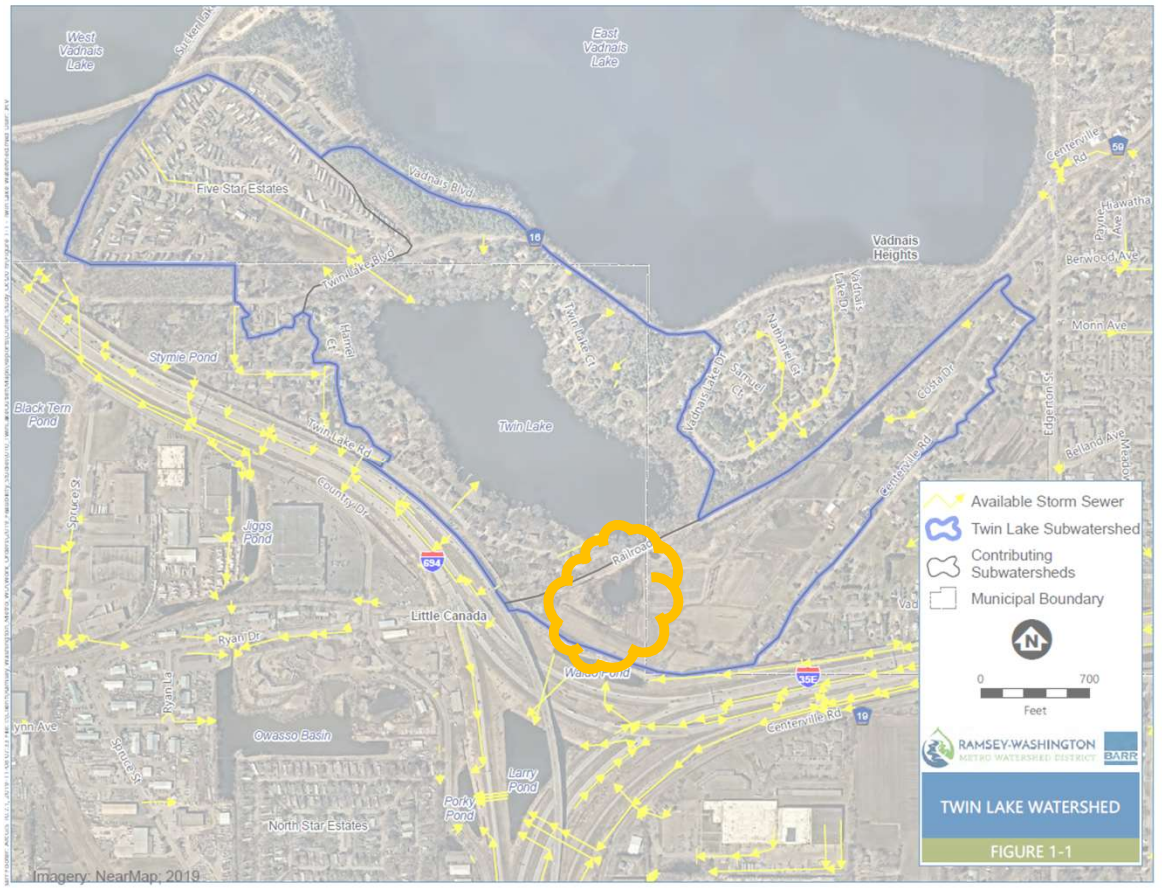
Alternative 3: Gravity Outlet at 874.0



- Grade ditch to embankment
- Gravity pipe through embankment
- Gate
- Access & easement acquisition
- Operation plan
- Estimated 30-year cost $153,000 – $285,000

Brief History of County Ditch 16 downstream of Twin Lake

- 1918: County Ditch 16 established
- 1947: Dubuque-Twin Cities petroleum pipeline constructed
- Mid-1960's: I-694 constructed
- 1966: profile of County Ditch 16
- 1975: RWMWD formed
- 1983: RWMWD takes over jurisdiction of county ditch system within RWMWD
- 1993: RWMWD completes Twin Lake hydrologic study
- 2005: Unweave-the-weave
- 2018: RWMWD receives request from Little Canada to review Twin Lake water levels
- 2019: West Vadnais overflows



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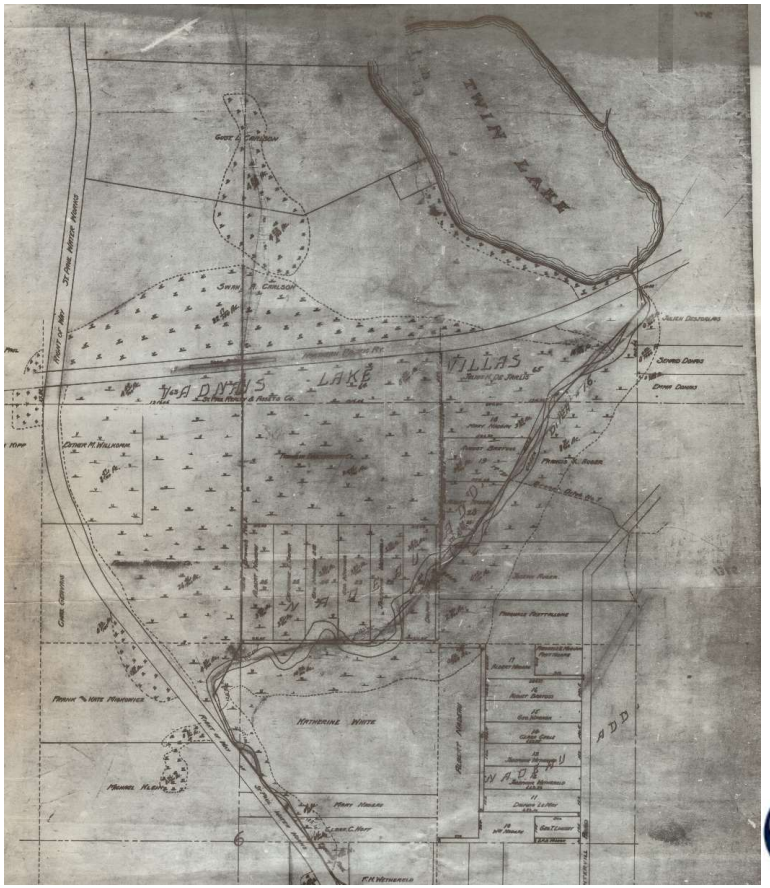

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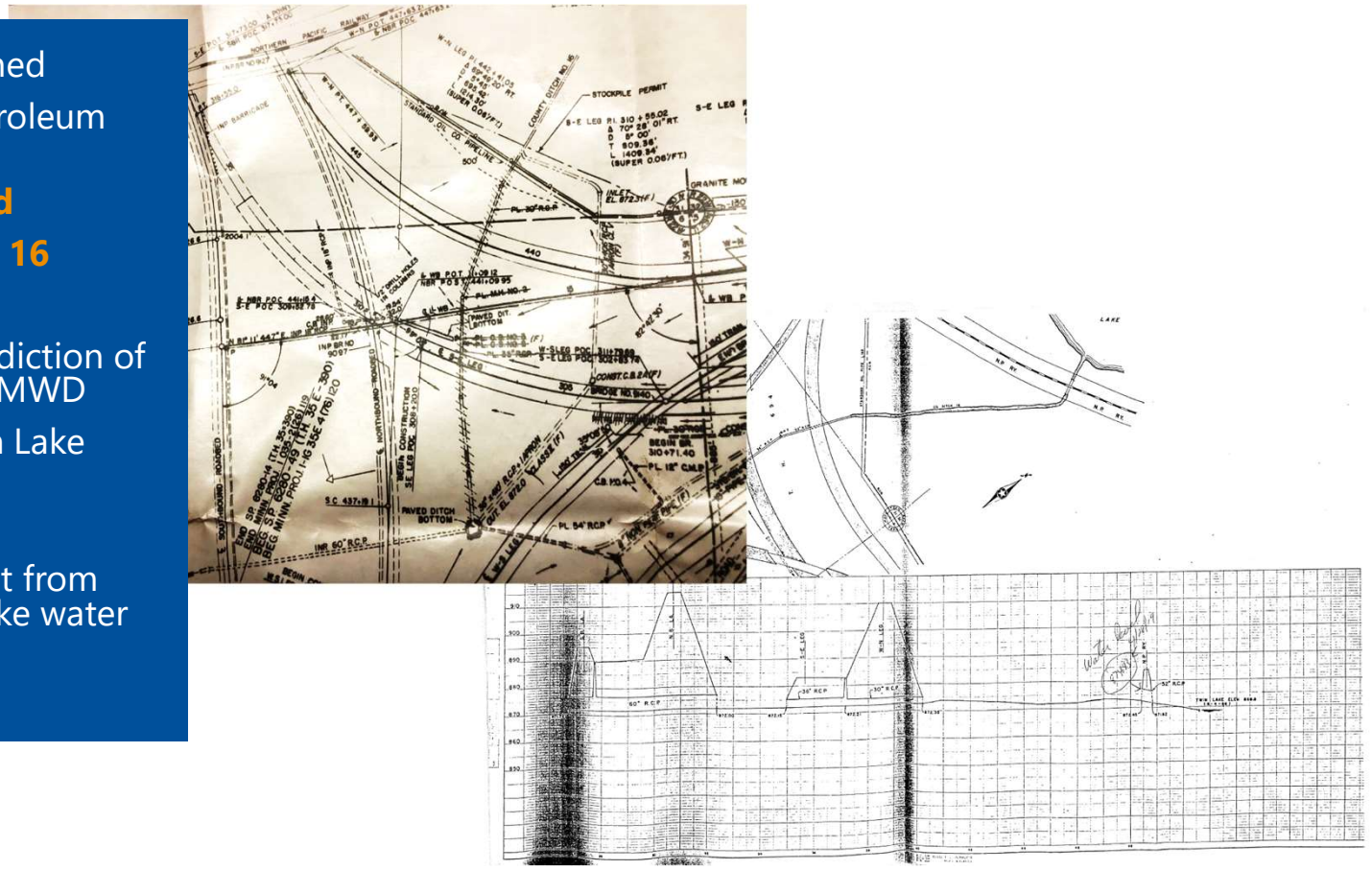

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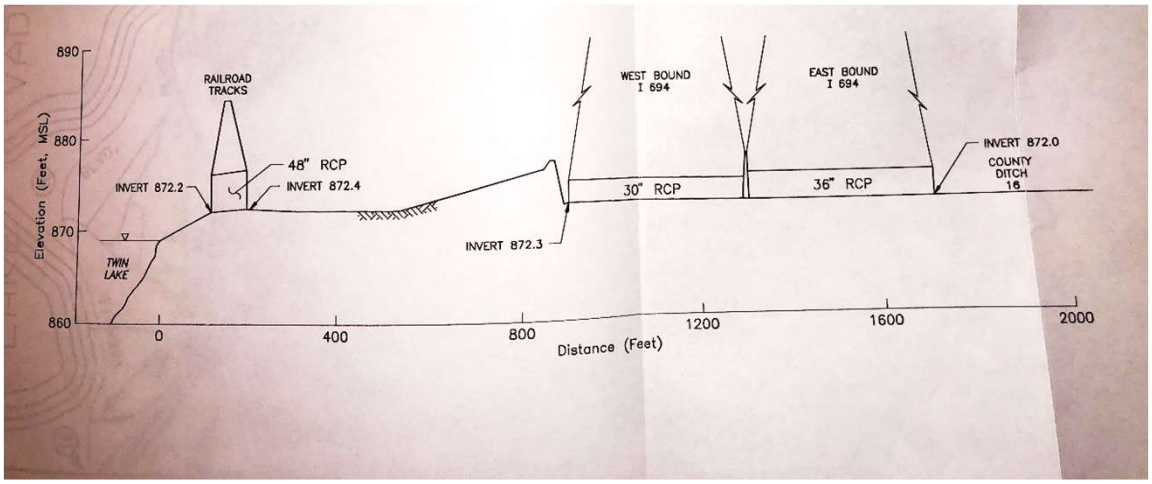

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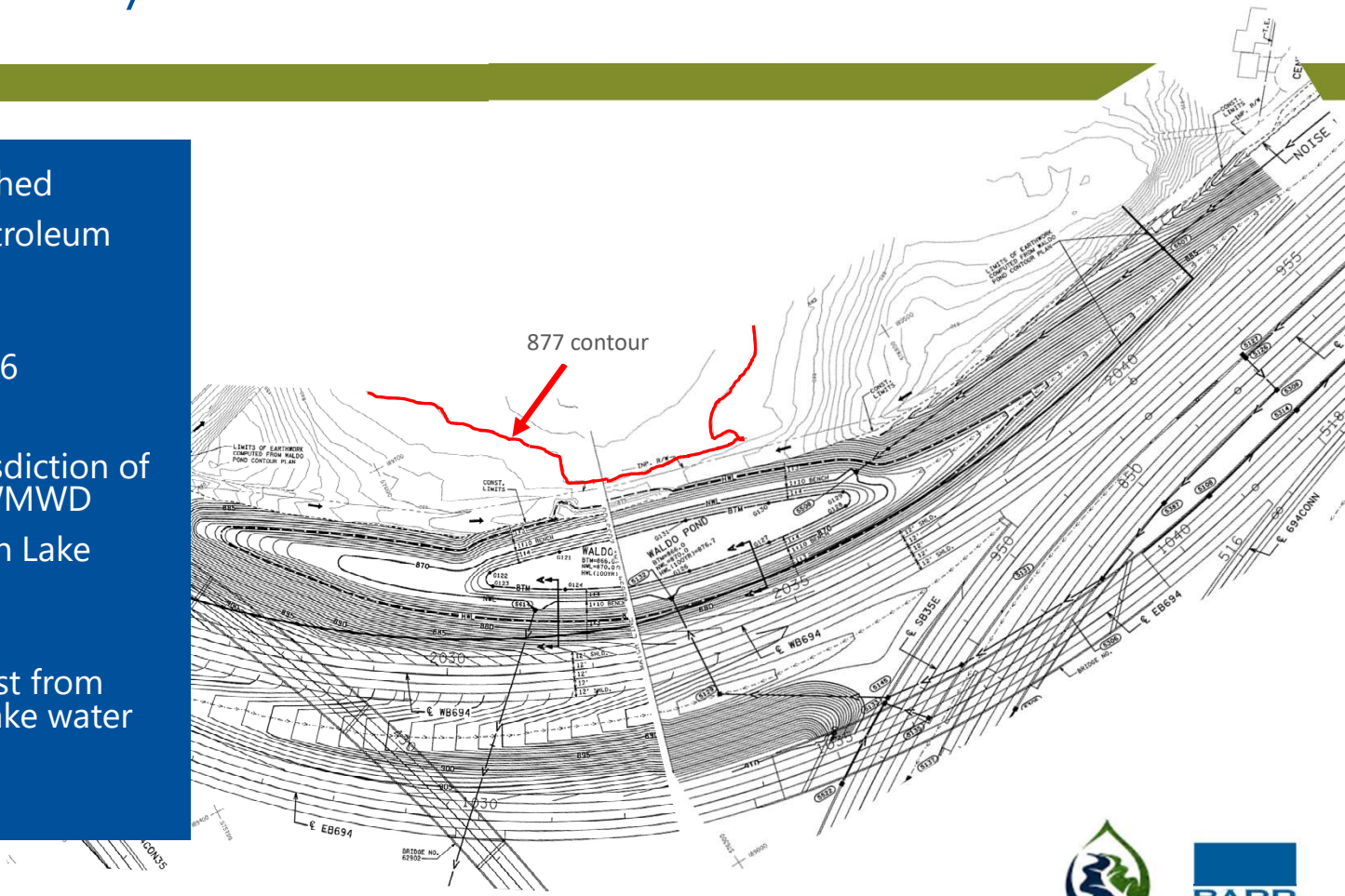

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