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IRRIGATION TRAINING & RESEARCH CENTER

Flathead Indian Irrigation Project
Valley View Unit Modernization

U.S. Bureau of Indian Affairs
Branch of Irrigation & Power

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VALLEY VIEW MODERNIZATION

Modernization Plan

The Valley View Canal System services an isolated area of approximately 10,000 acres. Figure 1 shows the overview of general modernization changes in the Valley View Canal System. The general modernization changes include:

1. A new water level control structure in the Pablo A Canal will provide better controllability of the multiple Valley View lateral headgates.
2. A new limited-demand pipeline will replace Sub-Lateral 31A-0.6.
3. A new flow control structure will be constructed approximately ¾ of the way down Sub-Lateral 31A-1 to "restart" the lateral flow rate. All excess flows will spill into a new channel that will then be pumped into Lateral 31A.
4. A new regulating reservoir will be constructed at the bifurcation of Lateral 31A and Sub-Lateral 31A-37. The reservoir will:
    a. Provide improved turnout flexibility both upstream and downstream
    b. Capture excess upstream canal flows and "restart" the downstream flow rate to Lateral 31A. The flow rate will have the ability to be changed at any time.
    c. Reduce operational spill at the end of Lateral 31A
    d. Ease management of the entire canal system for operators
5. The control at the existing Lateral 31A spill to an existing drain will be improved to:
    a. Provide better service to the last turnouts on Lateral 31A
    b. Measure the spill at the end of Lateral 31A so that the proper flow rate adjustments can be made further upstream at the canal "restart" point near the new reservoir
6. The existing water level control structures along Lateral 31A, Sub-Lateral 31A-0.7, and Sub-Lateral 31A-1 will be improved to:
    a. Maintain a fairly constant upstream water level over a wide range of flows in order to maintain a constant flow rate to turnout deliveries
    b. Automatically handle canal flow variations without manipulation from operators
7. New or improved flow measurement structures will be utilized at key locations to improve water management.
8. SCADA will be incorporated at various locations to help make effective operation and management decisions dealing with the movement of water throughout the canal system.
9. Vibratory compaction is recommended on the higher-elevation sub-laterals to reduce canal seepage.

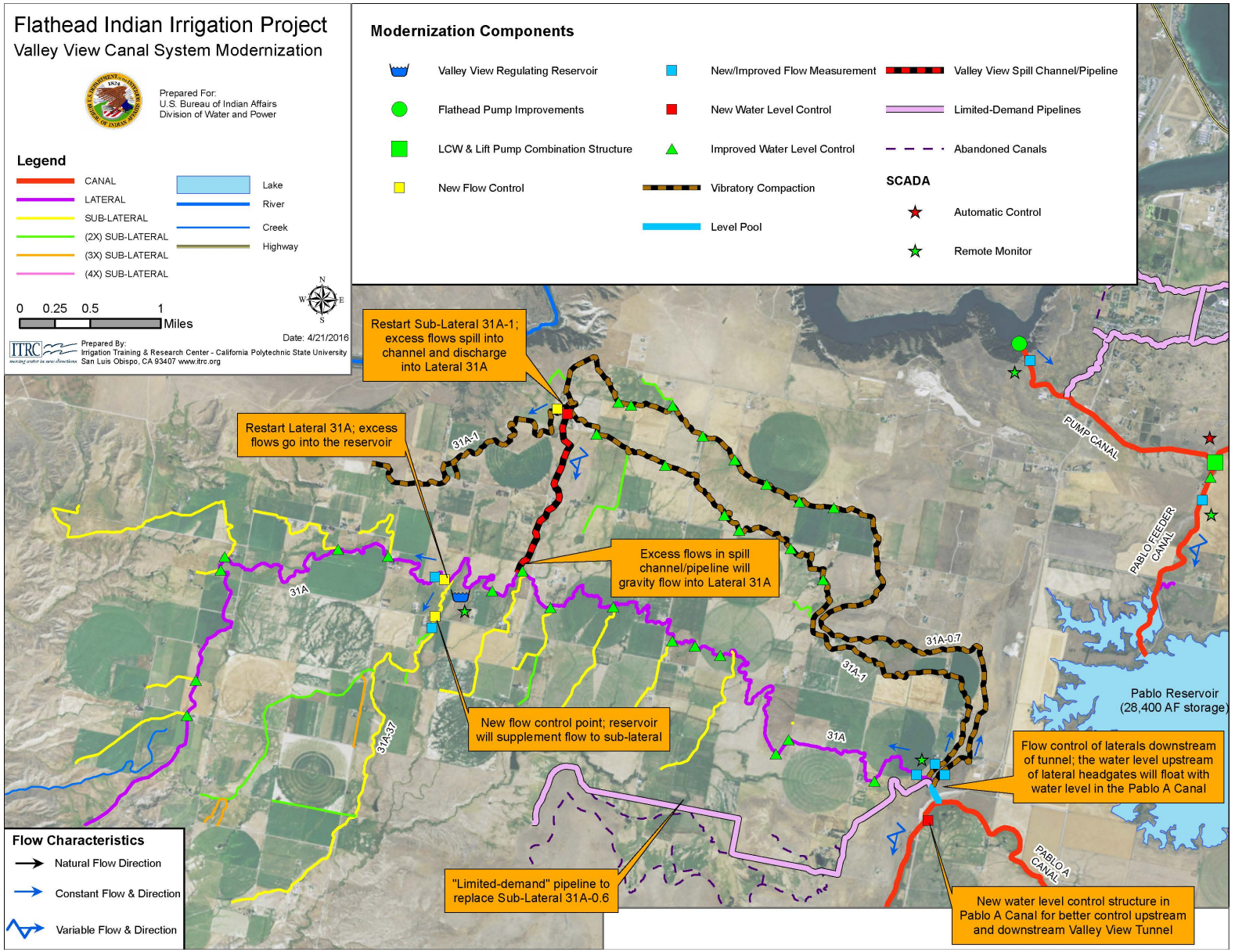

Figure 1. General overview of modernization changes in the Valley View Canal System

Control Improvements near the Valley View Tunnel

Existing Conditions

Figure 2 shows the existing canal system near the Valley View Tunnel.

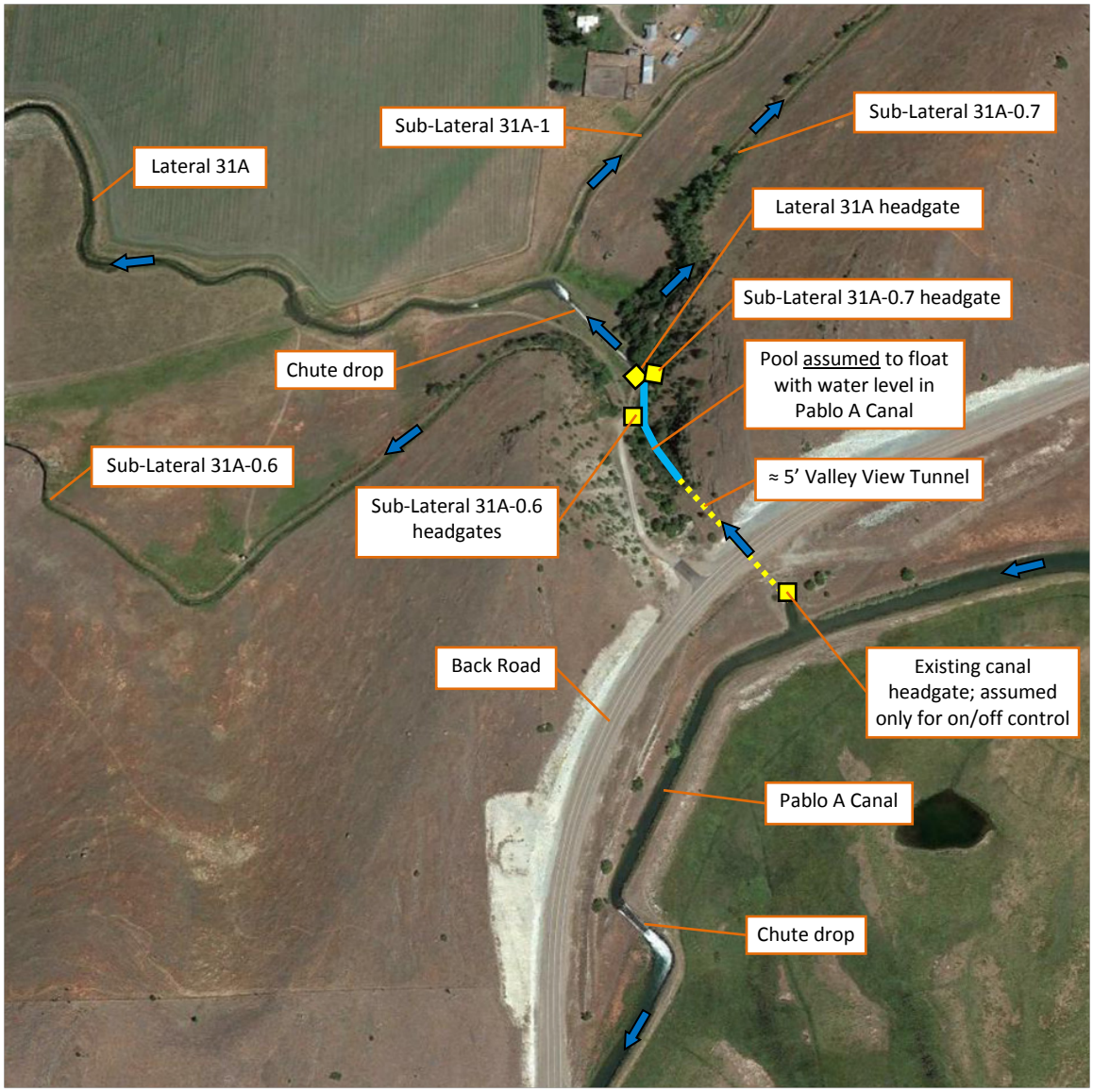

Figure 2. Aerial showing the Valley View Tunnel diversion on the Pablo A Canal

The existing control at the tunnel is as follows:

- There is currently no water level control structure in the Pablo A Canal downstream of the Valley View Tunnel diversion. Approximately 750 ft. downstream of the tunnel diversion is a large chute drop in the Pablo A Canal.
- It is estimated that up to 75 CFS is diverted from the Pablo A Canal through an approximately 5 ft. diameter rock tunnel with an approximate length of 400 ft.
- An existing sluice gate is installed at the entrance to the Valley View Tunnel (see Figure 3).

- Downstream of the Valley View Tunnel are the headgates for:
  - Lateral 31A
  - Sub-Lateral 31A-0.6
  - Sub-Lateral 31A-0.7

Figure 3. Existing sluice gate at the entrance to the Valley View tunnel (left) and tunnel discharge (right). Photos from HKM 2008 report.

Figure 4. Existing lateral headgates in pool downstream of the Valley View Tunnel discharge. Photo from HKM 2008 report.

It is assumed that the pool downstream of the Valley View Tunnel discharge floats with the water level in the Pablo A Canal based on the following reasons:

- From Figure 3, it appears that the sluice gate at the tunnel entrance never moves since the high water mark on the gate matches the high water mark on the concrete upstream.
- The tunnel discharge is not submerged.
- No water level control structure is present downstream of the tunnel discharge; only flow control gates are present. If the flow rate was being set using the existing sluice gate at the tunnel entrance, then there would need to be some type of water regulating structure present downstream of the tunnel discharge.
- Based on the high water marks present in Figure 4 it does not appear that the water in the pool downstream of the tunnel overtops the canal banks or the control structures.

ITRC was not able to survey the maximum water level at both ends of the tunnel during the site visit to confirm this assumption.

Modernization Changes at the Valley View Tunnel Entrance

Figure 5 shows modernization changes to be made in the Pablo A Canal near the Valley View Tunnel.

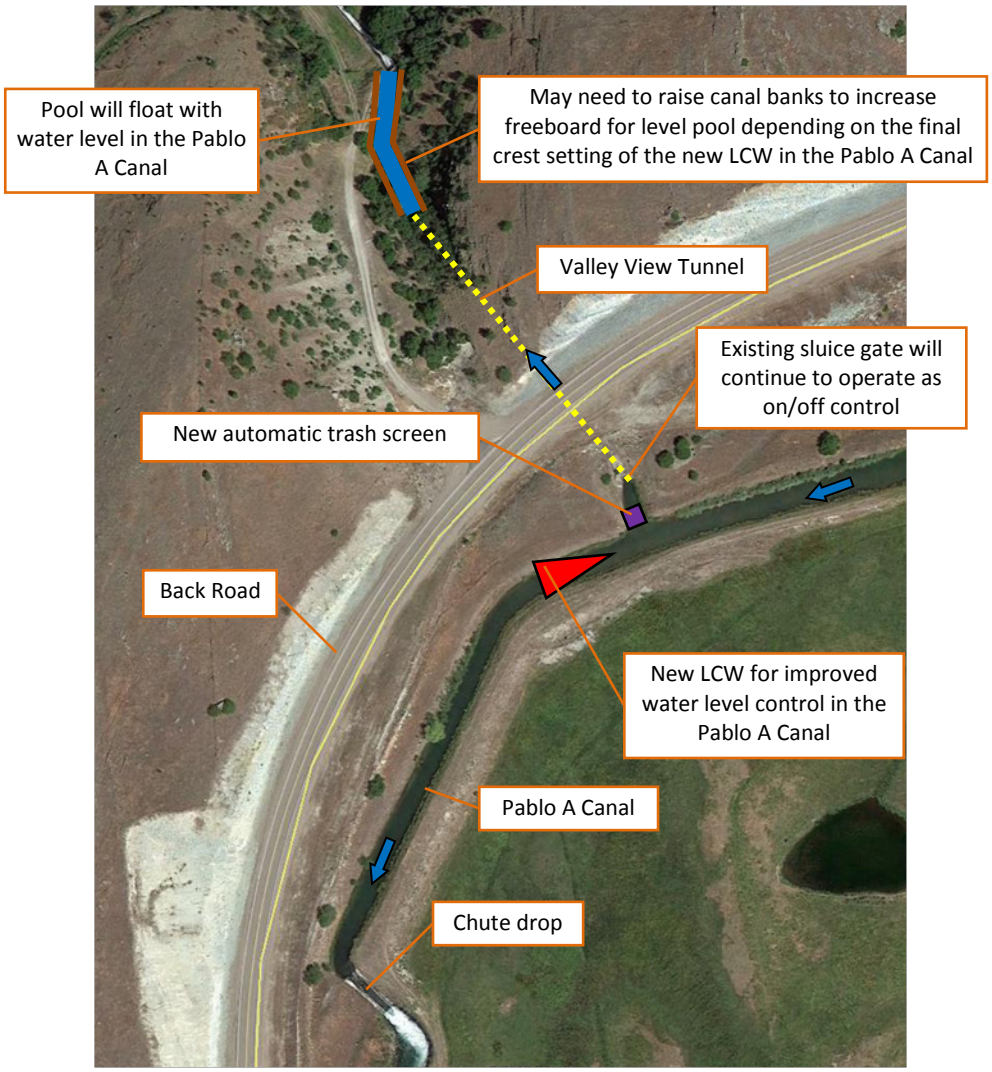

Figure 5. Approximate location for new water level control structure in the Pablo A Canal downstream of the Valley View Tunnel diversion

Good flow rate control at the headgates of Sub-Lateral 31A-0.7, Sub-Lateral 31A-0.6, and Lateral 31A requires that the water level at these headgates stays relatively constant over time. This water level, downstream of the tunnel, is almost the same as the water level in the Pablo A Canal. There is no water level control structure in the Pablo A Canal. A first step is to provide good water level control in the Pablo A Canal.

The modernization changes are as follows:

1. A new 80 ft. LCW will be constructed in the Pablo A Canal downstream of the Valley View Tunnel Entrance.
    a. The LCW will maintain the upstream water level in the Pablo A Canal as well as the water level in the canal pool downstream of the Valley View Tunnel discharge.
    b. The canal pool downstream of the tunnel discharge will float with the water level in the Pablo A Canal.
    c. Figure 6 shows a conceptual plan view of the new 80 ft. LCW structure.
2. A new automatic trash screen (solar powered) will be installed just upstream of the entrance to the Valley View Tunnel to remove any debris prior to entering the tunnel.
3. The existing sluice gate installed at the tunnel entrance will continue to operate as on/off control. No change is needed unless it is physically incapable of moving and sealing.
4. An elevation survey will need to be conducted to see if the existing canal banks downstream of the tunnel discharge need to be raised in order to accommodate the level pool. The level pool water surface elevation will depend on the crest elevation of the new LCW in the Pablo A Canal.

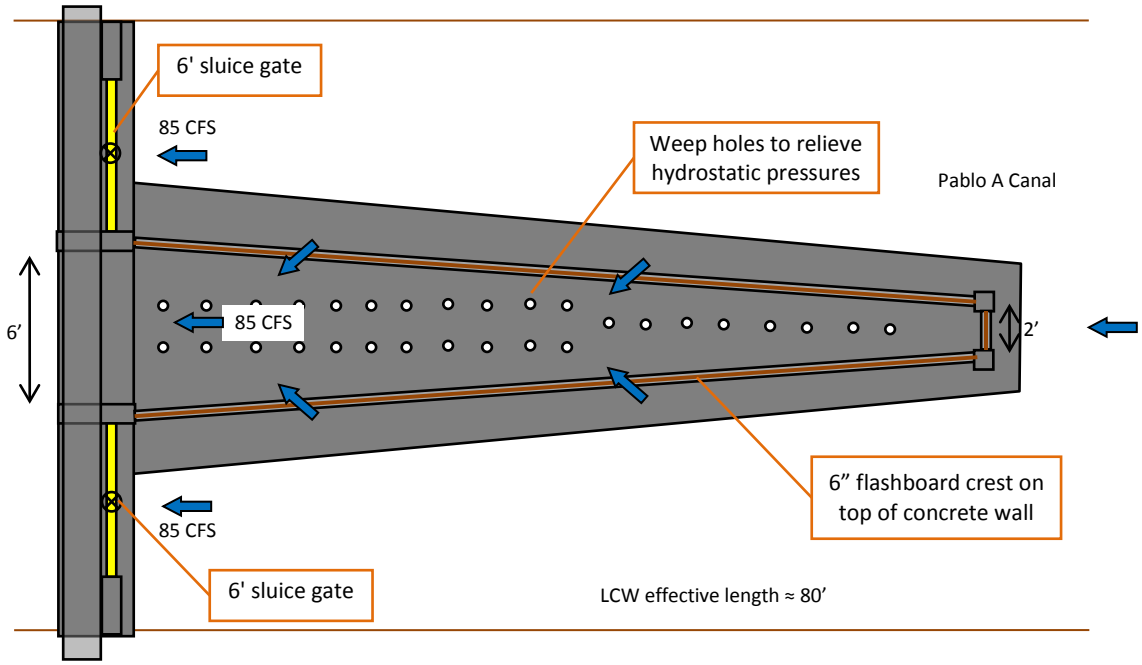

Figure 6. Conceptual plan view of new LCW structure in the Pablo A Canal downstream of the tunnel entrance to the Valley View Canal System (not to scale)

Existing Control at the Heads of the Valley View Laterals

Figure 7 is an aerial view of the existing canal control, downstream of the Valley View Tunnel.

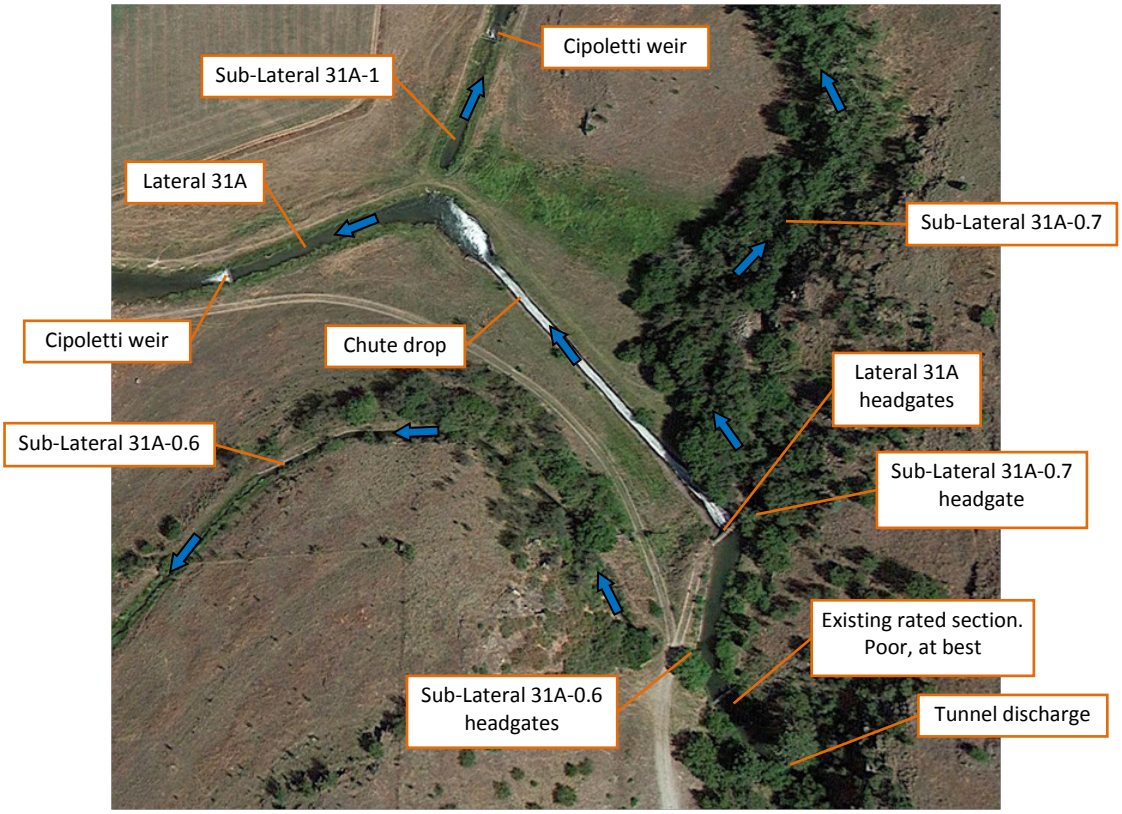

Figure 7. Valley View headworks downstream of tunnel discharge

The existing control downstream of the Valley View Tunnel discharge is as follows:

- Water discharges from the Valley View Tunnel and flows through an existing rated section shown in Figure 8 into a single canal pool.
- The water in the canal pool downstream of the tunnel is diverted into three separate laterals (Figure 9):
  - Lateral 31A
  - Sub-Lateral 31A-0.6
  - Sub-Lateral 31A-0.7
- The majority of the water is diverted into Lateral 31A where it flows down a large concrete drop chute shown in Figure 10. According to the HKM 2008 report, the chute is beginning to deteriorate.
- Immediately downstream of the chute is the Sub-Lateral 31A-1 headgates (see Figure 11) as well as a Cipoletti weir (see Figure 12) used for:
  - Raising the upstream water level for the sub-lateral headgate diversion
  - Measuring the downstream flow rate to Lateral 31A
- A smaller Cipoletti weir installed in Sub-Lateral 31A-1 (see Figure 13) is used to measure the downstream flow rate to the sub-lateral. The existing concrete floor on the downstream side may be causing the Cipoletti weir to be submerged, which then throws off the accuracy of the flow measurement reading.

Figure 8. Existing rated section downstream of the Valley View Tunnel discharge

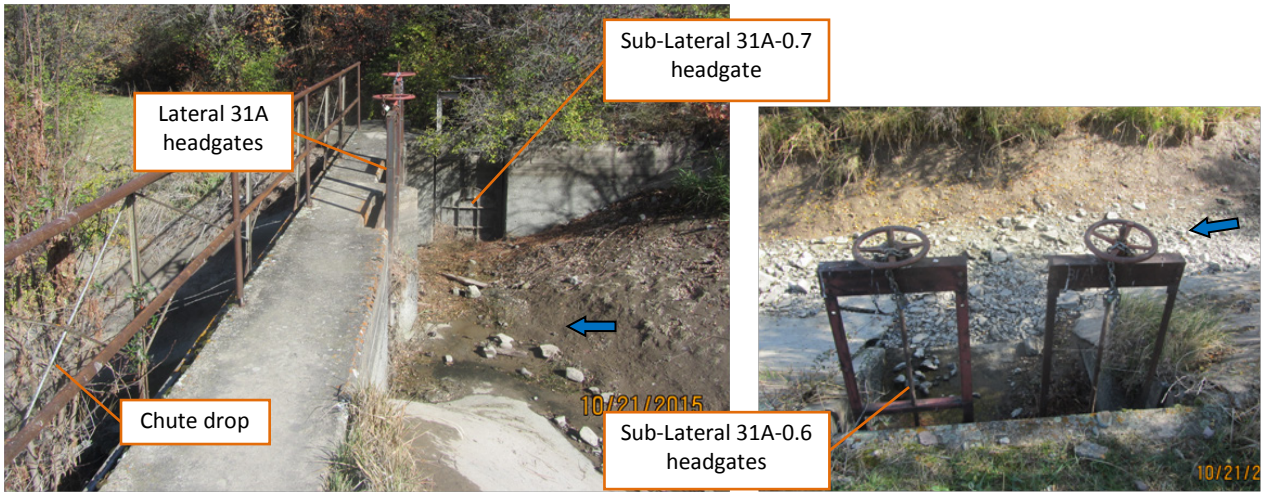

Figure 9. Lateral 31A, Sub-Lateral 31A-0.6, and Sub-Lateral 31A-0.7 headgates present downstream of the Valley View Tunnel discharge

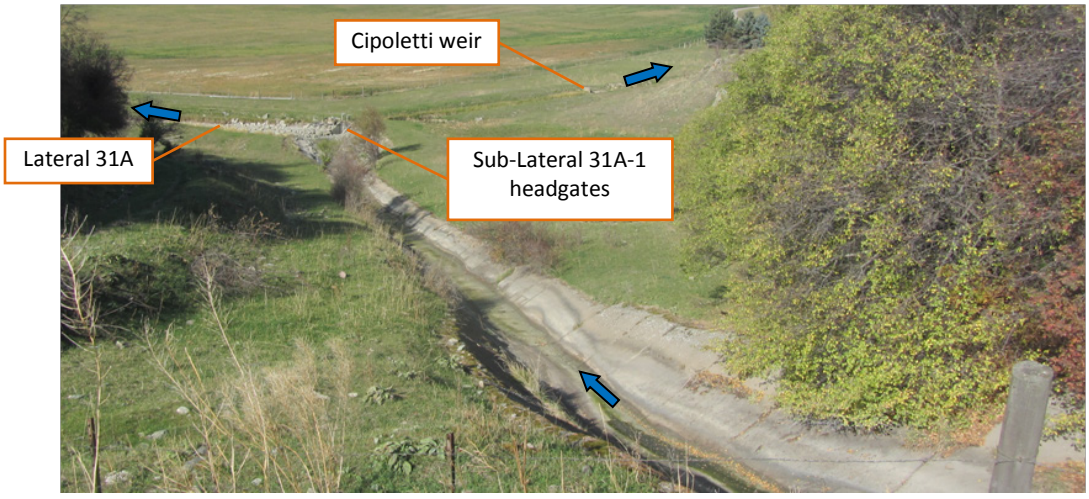

Figure 10. Lateral 31A concrete chute drop and location of Sub-Lateral 31A-1 headgates

Figure 11. Existing Sub-Lateral 31A-1 headgates

Figure 12. Existing Lateral 31A Cipoletti weir used for flow measurement and water level control for Sub-Lateral 31A-1 headgate located upstream. Photos from HKM 2008 report.

Figure 13. Existing Cipoletti weir in Sub-Lateral 31A-1. Photos from HKM 2008 report.

Modernization Changes just Downstream of the Valley View Tunnel

The modernization changes made downstream of the Valley View Tunnel discharge will focus on the following goals:

- Provide better control and measurement of the flows to each lateral
- Simplify management for operators

Figure 14 shows the modernization changes to be made downstream of the Valley View Tunnel discharge.

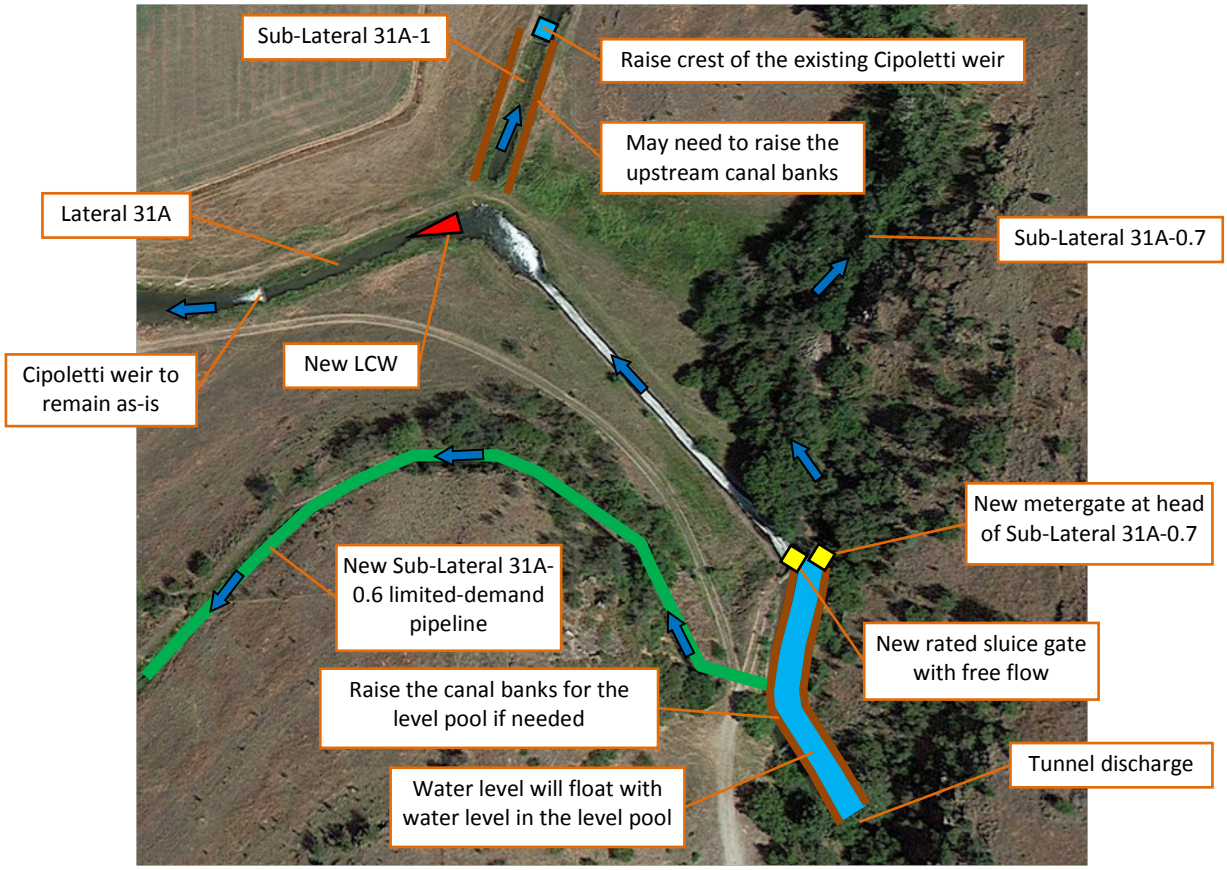

Figure 14. Modernization changes downstream of the Valley View tunnel

The modernization changes include the following:

1. The pool downstream of the Valley View Tunnel will float with the water level in the Pablo A Canal, which will be constantly held at a somewhat higher level than at present. The canal banks downstream of the tunnel may need to be raised to accommodate the floating pool. There should be a minimum of 1.0' head loss across the new metergate at the head of Sub-Lateral 31A-0.7.
2. A new metergate will be installed at the head of Sub-Lateral 31A-0.7 to control and measure the flow rate into the sub-lateral.
3. Sub-Lateral 31A-0.6 will be replaced with a new limited-demand pipeline. The design summary of the new limited-demand pipeline will be explained in a later section of this report.

4. A new sluice gate will be installed at the head of the chute. It should be installed so that it operates in a free-flow condition, with suppressed side and bottom entrance conditions. With those hydraulic conditions, the rating tables from books can be used. This gate will be used for both flow control and measurement.
5. The existing headgates at the head of Sub-Lateral 31A-1 appear to be functional for flow rate control. However, the Cipoletti weir downstream of them, in Sub-Lateral 31A-1, appears to be submerged at times. Therefore, that weir crest should be raised by about 1.0' to prevent submergence. This may require the raising of the canal banks for the short distance between the head of the sub-lateral and the Cipoletti weir.
6. A long-crested weir (LCW) in Lateral 31A, just downstream of the head of Sub-Lateral 31-A, is needed for easy control of the water levels. It should have an effective length of 40 feet and be configured as shown in Figure 15.

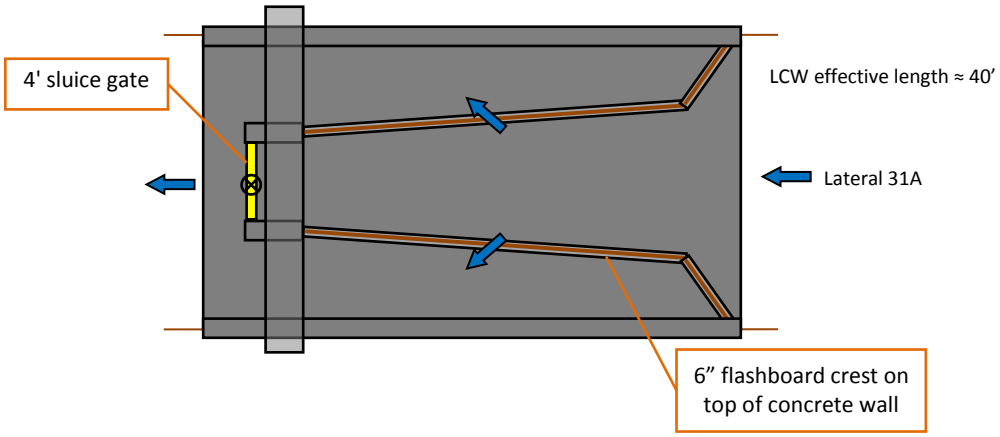

Figure 15. Conceptual plan view of new LCW structure in the Lateral 31A downstream of the Sub-Lateral 31A-1 headgate (not to scale)

Sub-Lateral 31A-1 Restart and Spill

General Overview

Figure 16 shows the existing canal alignments near Valley View and Peace Roads.

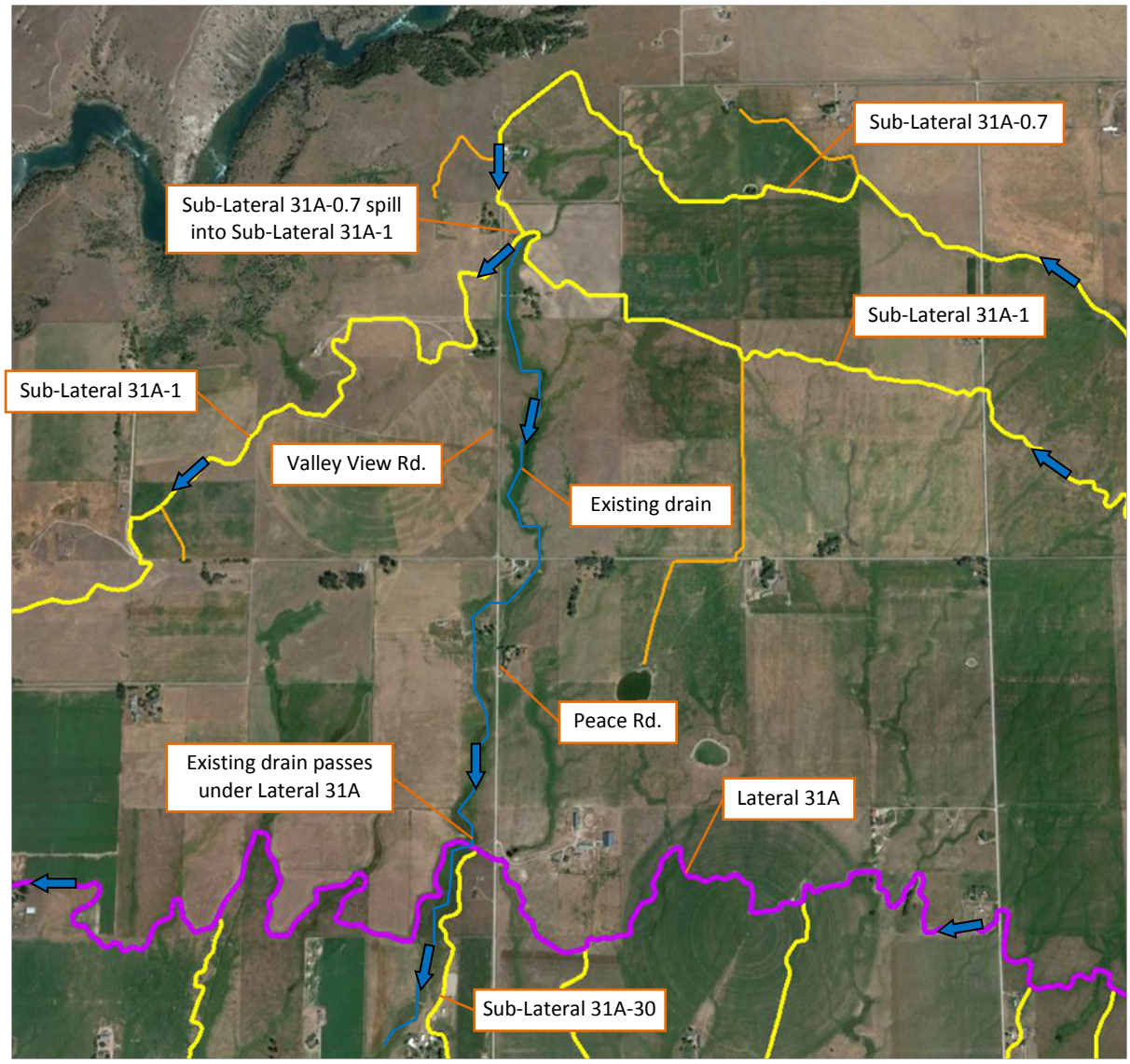

Figure 16. Existing lateral alignments near Valley View and Peace Roads

The general existing control is as follows:

- Excess flows at the terminus of Sub-Lateral 31A-0.7 spill in Sub-Lateral 31A-1.
- Sub-Lateral 31A-1 continues on for another two miles servicing multiple farmer turnouts.
- An existing drain forms near the terminus of Sub-Lateral 31A-0.7 and meanders south, collecting tailwater runoff from the nearby fields.
- The existing drain crosses under Lateral 31A and continues south until it finally discharges into the Flathead River.

General Modernization Changes

The new operation scheme for Sub-Laterals 31A-0.7 and 31A-1 will call for extra flow to be diverted into each sub-lateral in order to increase flexibility to the farmer turnouts. This will create an excess in flow at the convergence point of the two laterals. Instead of allowing the excess flow to continue down Sub-Lateral 31A-1 to service a small agricultural area, the excess flows will be purposely diverted into a new spill system and eventually discharged into Lateral 31A. There the excess flow will be captured and re-regulated with a new reservoir.

Figure 17 shows the general modernization changes for the new Sub-Lateral 31A-1 spill channel.

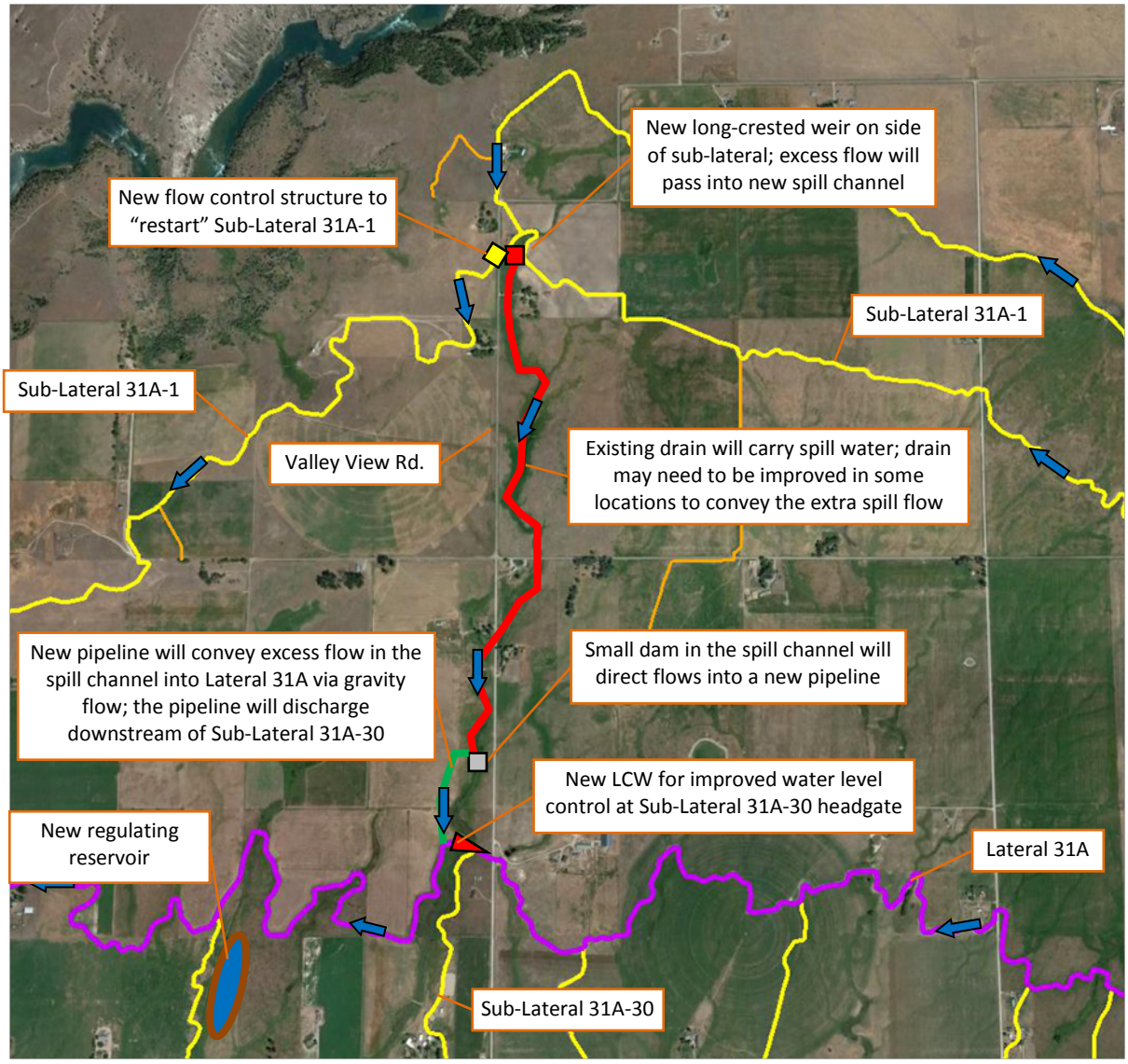

Figure 17. New Sub-Lateral 31A-1 spill channel

The general modernization changes include:

1. A new flow control structure will be constructed in Sub-Lateral 31A-1 to "restart" the flow rate to the last two miles of Sub-Lateral 31A-1.
2. A new water level control structure (likely a LCW) will be constructed on the side of Sub-Lateral 31A-1, upstream of the new flow control structure in Sub-Lateral 31A-1 to:
    a. Maintain the water level upstream of the new flow control structure
    b. Automatically pass excess flows into the existing drain
3. The existing drain will be utilized as a new spill channel to convey excess flows from Sub-Laterals 31A-0.7 and 31A-1 south to Lateral 31A. The drain may need to be excavated in certain portions to better accommodate the spill flow.
4. A new LCW will be constructed in Lateral 31A, just downstream of the entrance to Sub-Lateral 31A-30.
5. In the drain (spill channel) upstream of Lateral 31A (perhaps 1500' upstream), a small diversion dam will be constructed. Flow from the drain will enter a pipeline that will then discharge into Lateral 31A downstream of the new LCW and the Sub-Lateral 31A-30 headgate. The diameter of the pipe will depend upon the actual elevations and flow rates that are anticipated.
6. A regulating reservoir will be constructed downstream on Lateral 31A to capture and re-regulate the flows in Lateral 31A.

The following sections explain the modernization changes at individual locations for the new spill channel network.

Sub-Lateral 31A-0.7 Spill

Figure 18 shows the existing control at the Sub-Lateral 31A-0.7 spill into Sub-Lateral 31A-1.

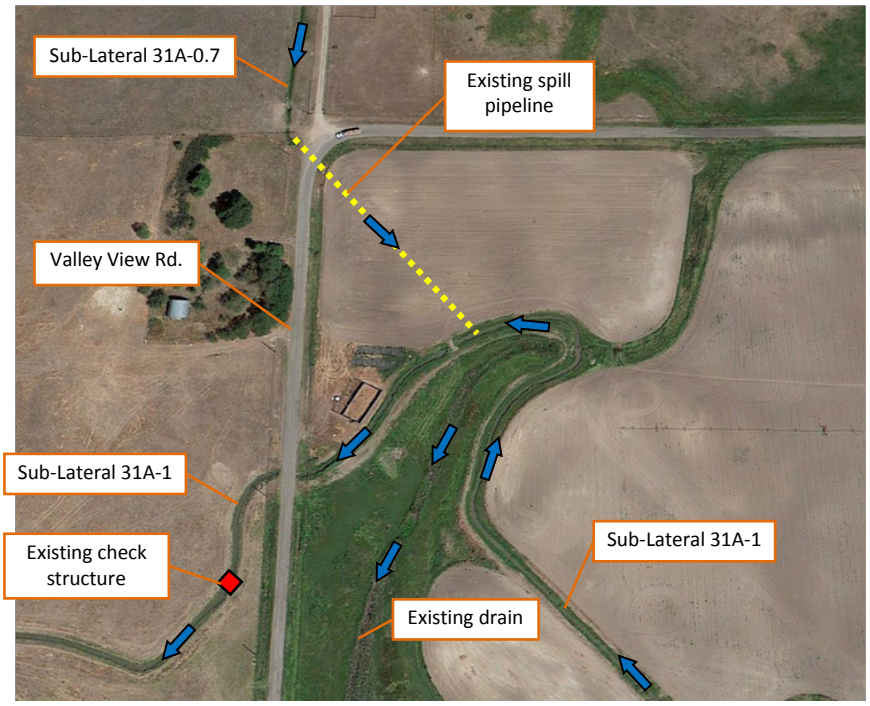

Figure 18. Existing Sub-Lateral 31A-0.7 spill

Excess flows at the terminus of Sub-Lateral 31A-0.7 spill into Sub-Lateral 31A-1 via a pipeline. The excess flow continues down Sub-Lateral 31A-1 to service turnouts located along the last two miles of the lateral. A drain collects tailwater runoff from nearby fields and conveys the drainage flows to the south. Currently there is no spill structure in Sub-Lateral 31A-1 to the existing drain.

Modernization Changes

Figure 19 shows the modernization changes at the terminus of Sub-Lateral 31A-0.7.

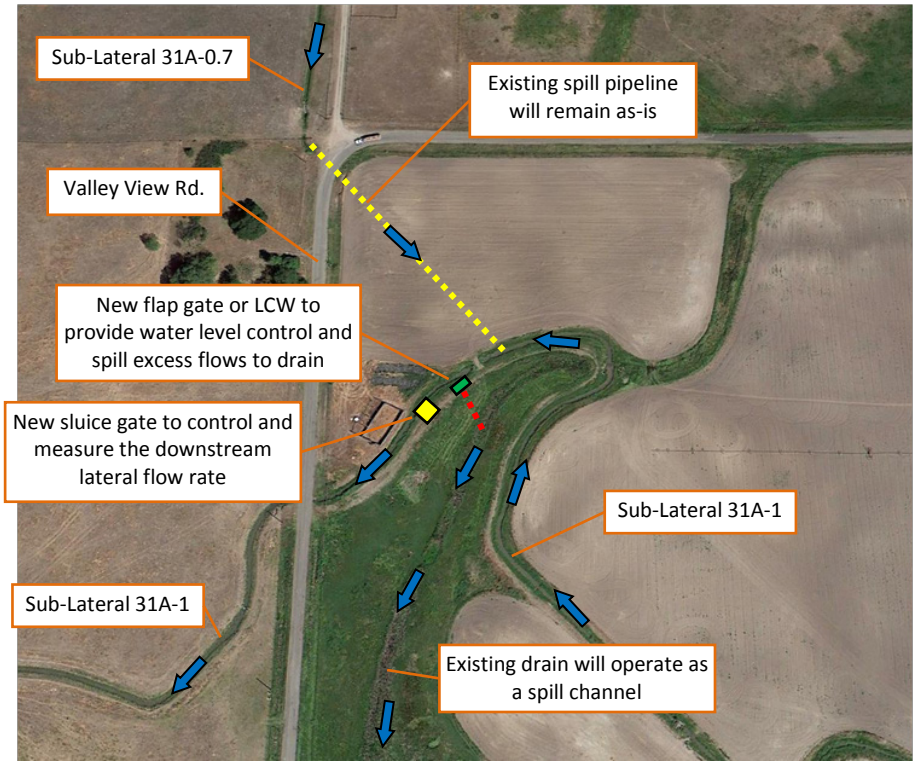

Figure 19. Modernization changes at the terminus of Sub-Lateral 31A-0.7

The modernization changes include:

1. The existing Sub-Lateral 31A-0.7 spill into Sub-Lateral 31A-1 will remain as-is.
2. The existing check structure in Sub-Lateral 31A-1 located downstream of Valley View Road will remain.
3. A new flow control sluice gate will be installed in Sub-Lateral 31A-1 upstream of the Valley View Road crossing, just downstream of the existing spill pipe.
4. Either a new flap gate or LCW will be installed on the side of Sub-Lateral 31A-1 downstream of the spill discharge from Sub-Lateral 31A-0.7, and upstream of the new sluice gate, to:
    a. Maintain the upstream water level for the new flow control structure
    b. Automatically pass all excess flows from the two sub-laterals into the existing nearby drain
5. The existing drain will operate as a new spill channel to convey excess water south to be utilized in Lateral 31A. Portions of the existing drain may need to be excavated to accommodate the spill flow, which will now be continuous.

Spill Discharge into Lateral 31A

Figure 20 shows the existing control in Lateral 31A at the Sub-Lateral 31A-30 diversion.

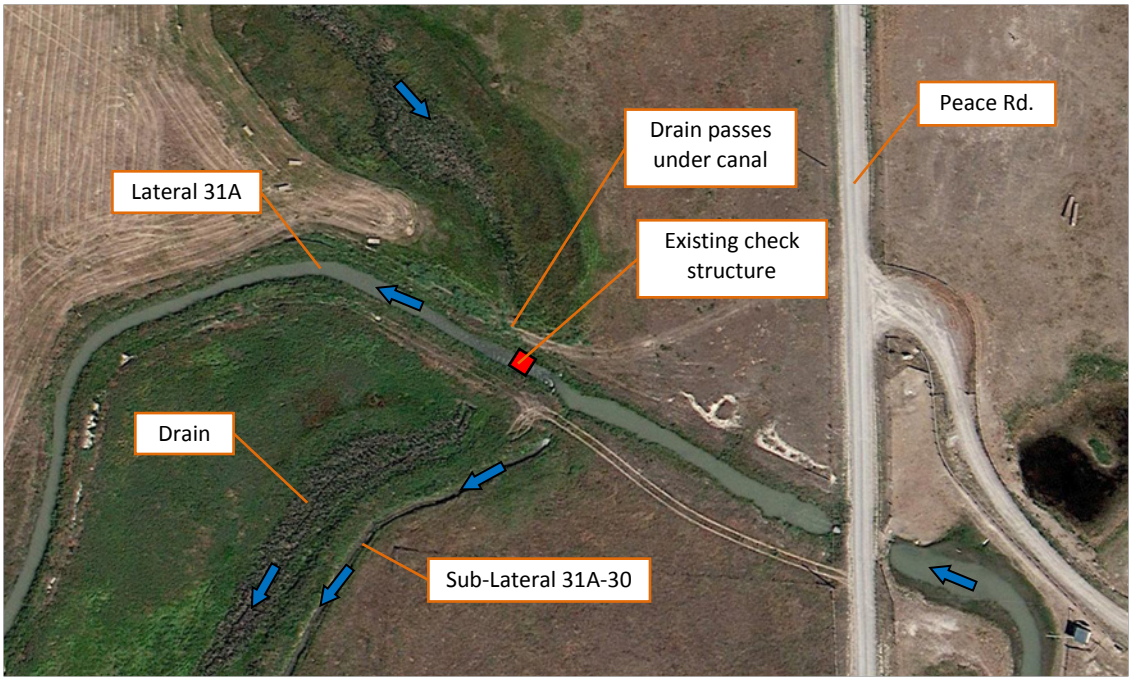

Figure 20. Existing control in Lateral 31A at the Sub-Lateral 31A-30 headgate and drain underpass

An existing check structure in Lateral 31A (see Figure 21) regulates the upstream water level for the Sub-Lateral 31A -30 diversion. The same drain that originates near the terminus of Sub-Lateral 31A-0.7 in the north conveys any drainage flows under Lateral 31A to continue heading south until the drain water eventually spills to the Flathead River.

Figure 21. Existing check structure in Lateral 31A downstream of the Sub-Lateral 31A-30 headgate. Photo from HKM 2008 report.

Modernization Changes

Approximately 1500' upstream of Lateral 31, in the drain, a small diversion dam will be constructed to direct spill water and return flows into a pipeline (see Figure 22). That pipeline will discharge into Lateral 31A downstream of the check structure for Sub-Lateral 31A-3. There should be a good trash rack at the entrance to the pipeline. Other changes to Lateral 31A are shown in Figure 23 and consist of the following:

1. The existing check structure in Lateral 31A located downstream of the sub-lateral headgate will be replaced with a new 30' LCW structure for improved upstream water level control.
2. A metergate will be installed at the head of Sub-Lateral 31A-30 to control and measure the flow rate down the sub-lateral.

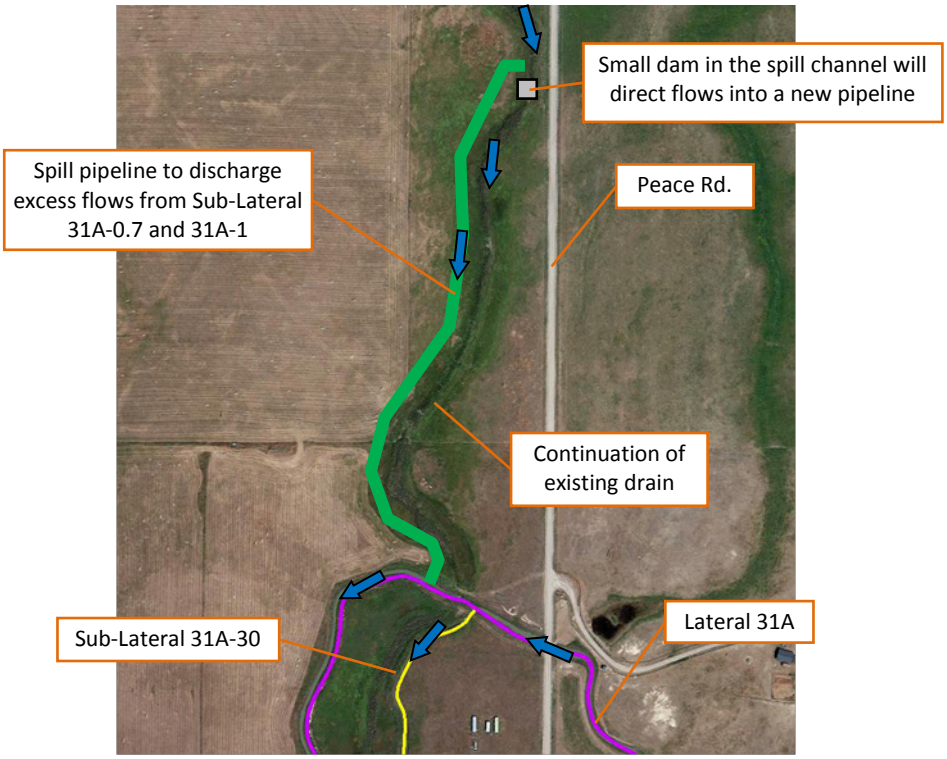

Figure 22. Approximate location of small diversion dam in spill channel

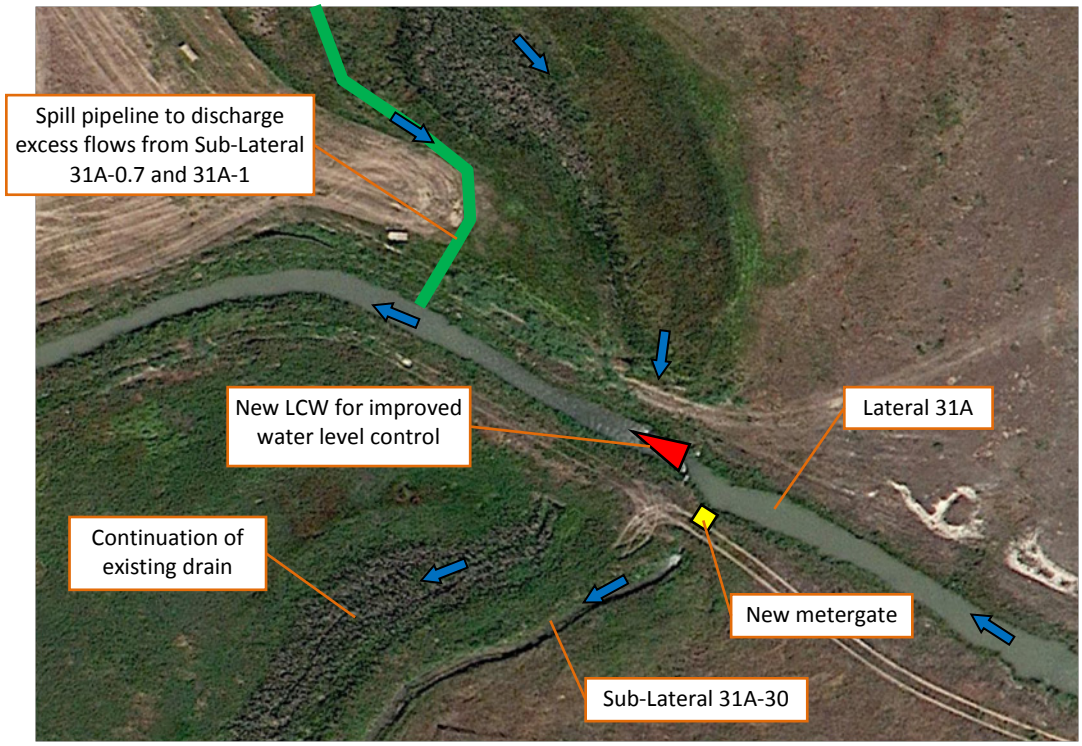

Figure 23. Proposed control in Lateral 31A at the Sub-Lateral 31A-30 headgate

Lateral 31A Regulating Reservoir

Location and Existing Conditions

A new regulating reservoir is proposed to be constructed in the Valley View Canal System as shown in Figure 24. The reservoir will be located approximately halfway down the alignment of Lateral 31A at the bifurcation with Sub-Lateral 31A-37.

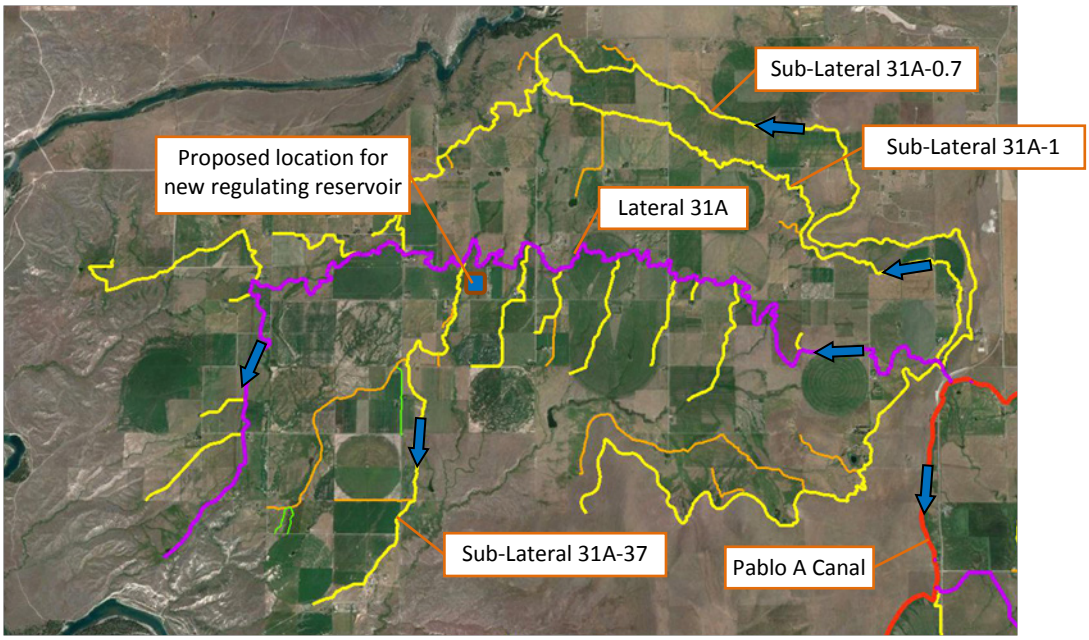

Figure 24. Approximate location of proposed regulating reservoir in the Valley View Canal System

Figure 25 shows the proposed field (approximately 6.5 acres) chosen for the regulating reservoir and the existing canal control nearby. The existing control is as follows:

- A two-bay existing check structure in Lateral 31A maintains the upstream water level for the Sub-Lateral 31A-37 headgates (see Figure 26).
- Two manual canal gates control the flow rate to Sub-Lateral 31A-37, which provides water to a significant amount of the agricultural area in the Valley View Canal System.
    - It is unknown how the flow rate to the sub-lateral is measured.
    - There appears to be a couple of feet of elevation change between Lateral 31A and the discharge to Sub-Lateral 31A-37.
- A manual waste gate (see Figure 27) is installed in Lateral 31A approximately 1,100 ft. upstream of the Sub-Lateral 31A-37 headgates. When the waste gate is opened, excess water spills into a nearby drain that continues south until it eventually discharges into the Flathead River.
- There are two existing check structures on Sub-Lateral 31A-37 with the first 2,000 ft. of the sub-lateral alignment. Each structure appears to have a fairly large elevation drop on the downstream side.

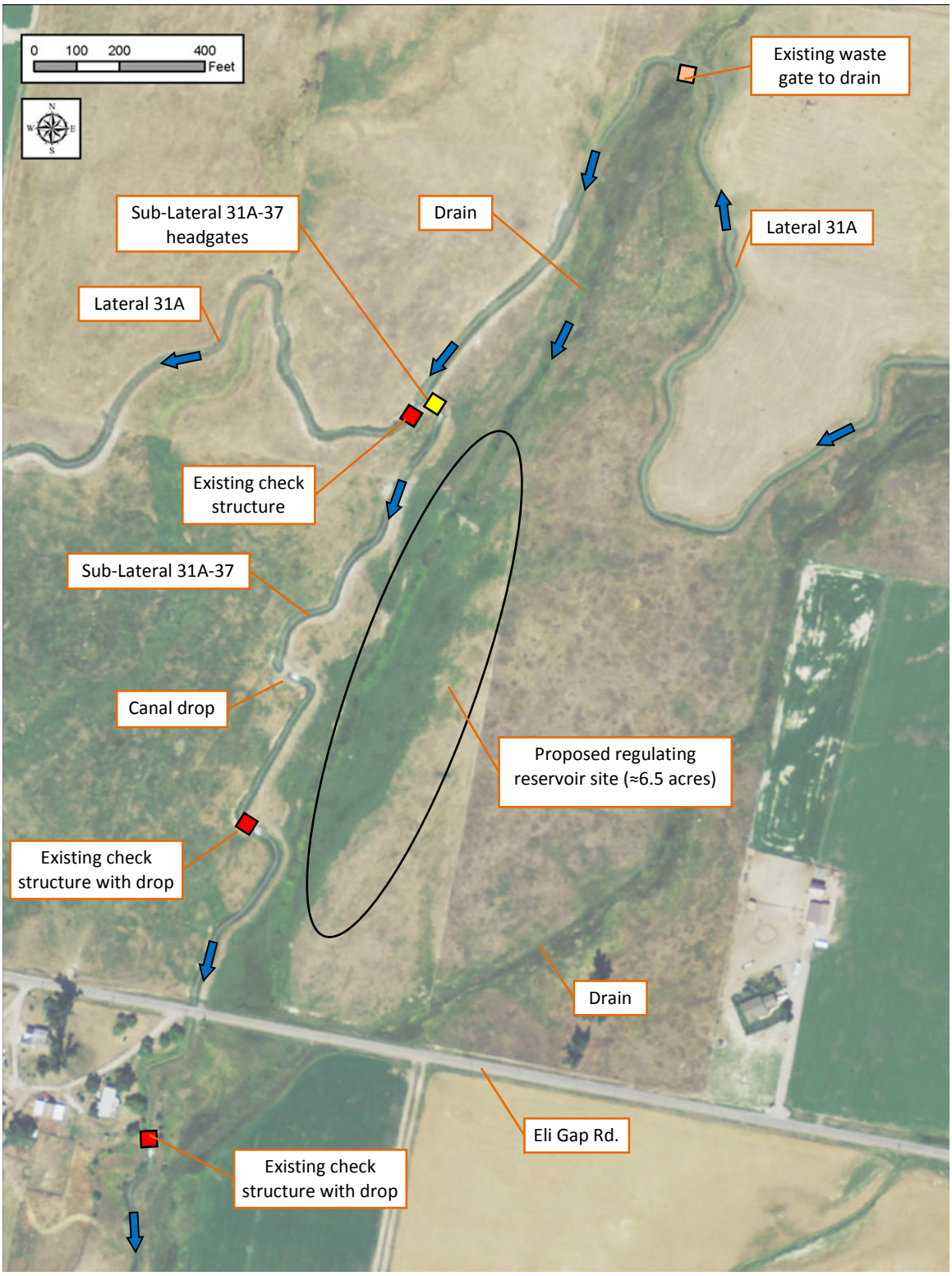

Figure 25. Existing control near proposed regulating reservoir location on Lateral 31A

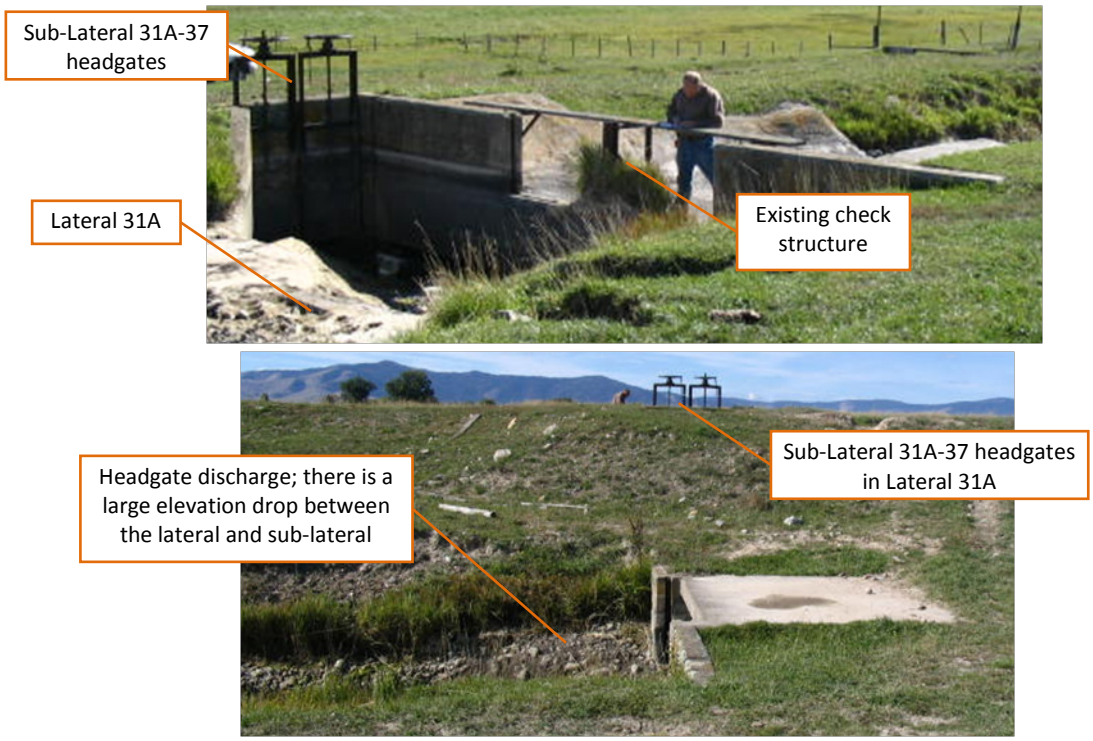

Figure 26. Existing check structure in Lateral 31A at the head of Sub-Lateral 31A-37 (top) and Sub-Lateral 31A-37 discharge (bottom). Photos from 2008 HKM report.

Figure 27. Existing waste gate to nearby drain. Photo from 2008 HKM report.

Figure 28 shows estimated 5 ft. elevation contours near the proposed regulating reservoir site. The elevation contours were developed from the National Elevation Dataset (NED) provide by the USGS. Based on the elevation contours, the reservoir will consist of one large single cell that will have gravity inflow and pumped outflow.

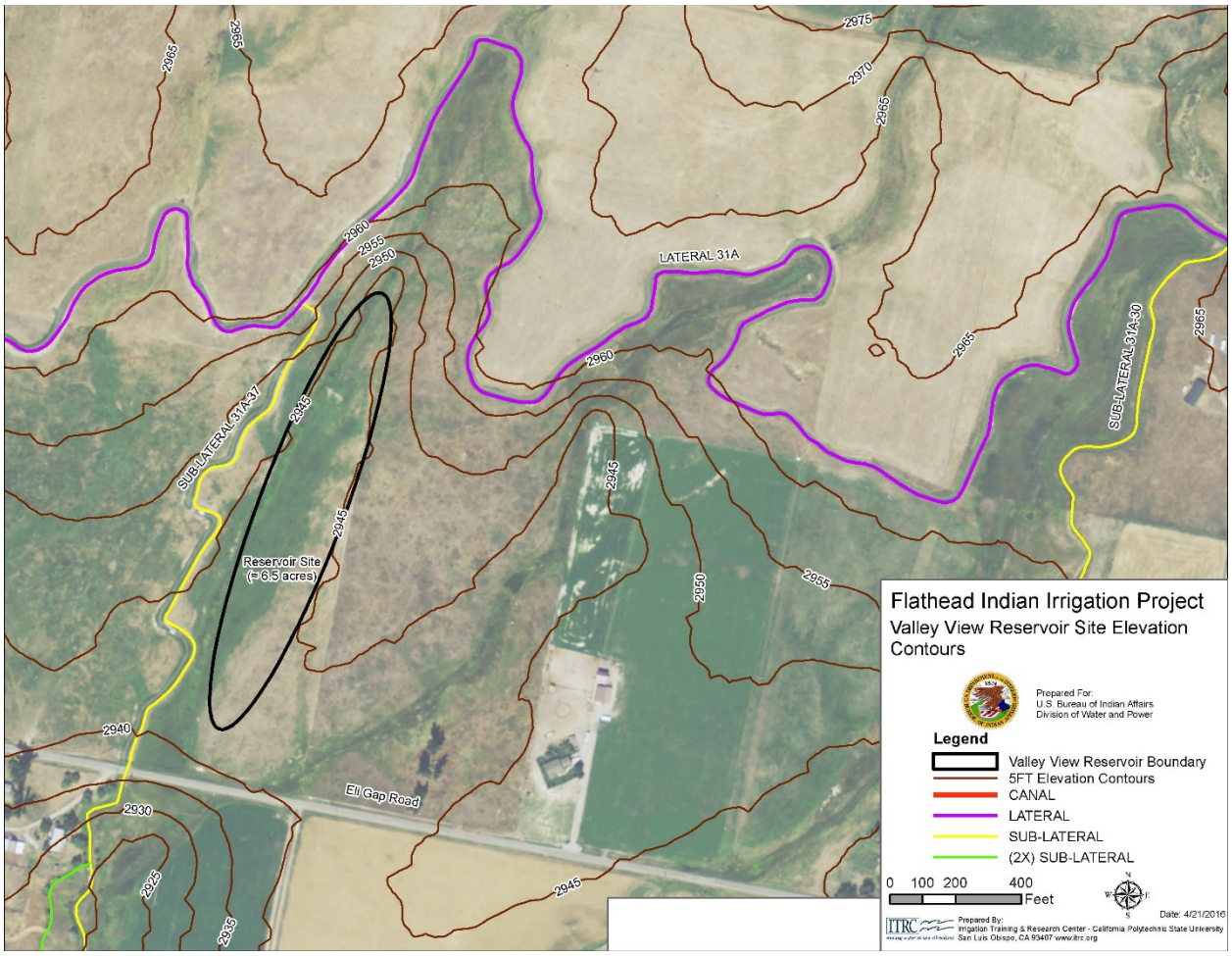

Figure 28. Estimated 5' elevation contours of the proposed Valley View regulating reservoir site. Elevation contours were produced from the National Elevation Dataset (NED) provided by the USGS.

Benefits of the Valley View Regulating Reservoir

The construction of the Valley View regulating reservoir will provide many operational and management benefits. The benefits are as follows:

- Increased flexibility will be provided to lateral and turnout deliveries both upstream and downstream of the reservoir.
- The reservoir will capture and re-regulate excess flows that will spill into Lateral 31A from Sub-Laterals 31A-0.7 and 31A-1.
- The flow rate to the downstream portion of Lateral 31A will have the ability to be "restarted" at any time. Lateral 31A essentially become two shorter canal segments rather than one long canal.
- The amount of operational spill at the tail end of Lateral 31A will be reduced.
- Management difficulties for the entire Valley View area will be decreased for operators.

Reservoir Control Components

Figure 29 shows the control components for the new 40 AF Valley View regulating reservoir.

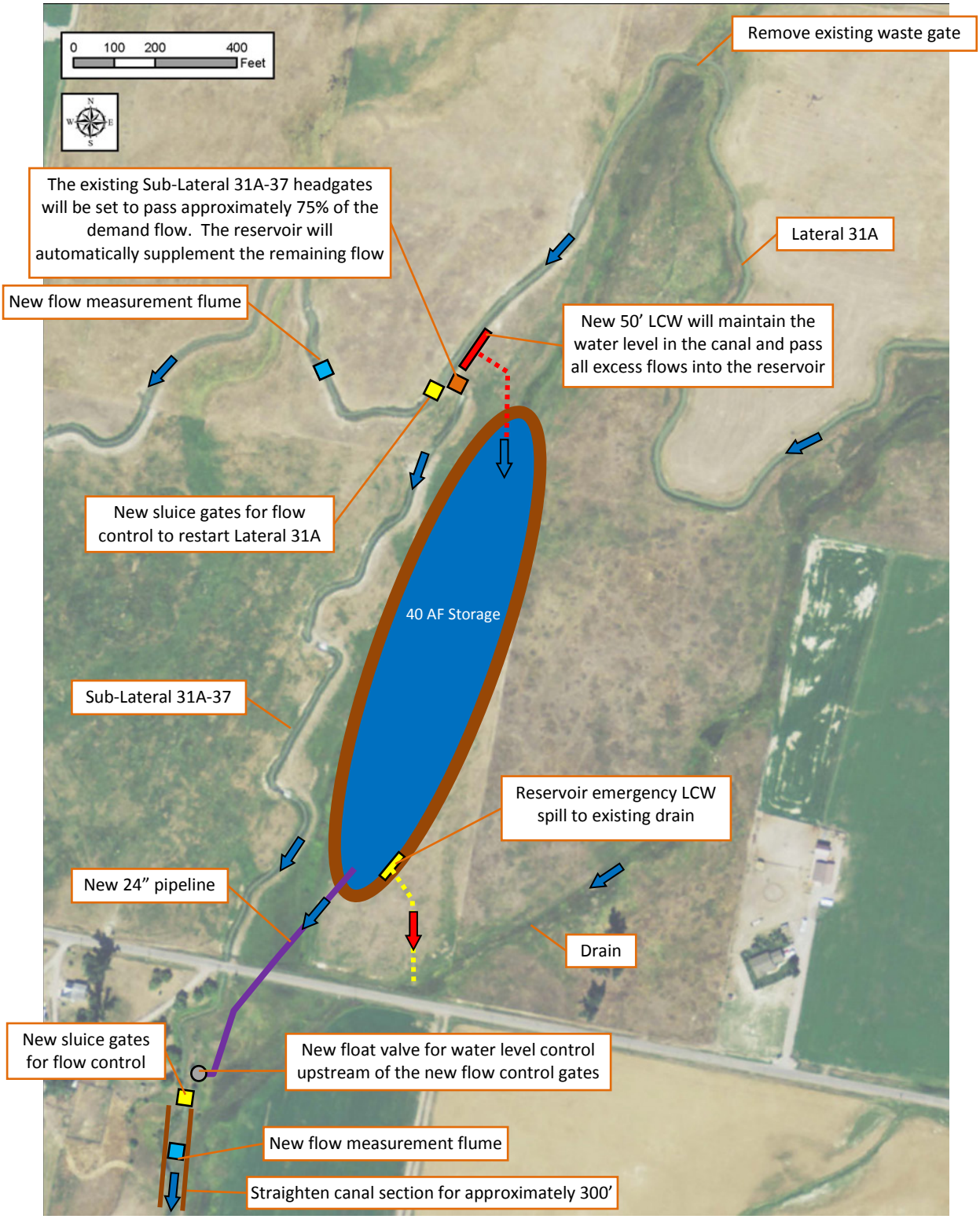

Figure 29. Control components of the new Valley View Regulating Reservoir

The control components include the following:

1. The existing waste gate in Lateral 31A will be removed.
2. The existing check structure in Lateral 31A will be replaced with a new flow control structure to restart the flow rate in the canal. Multiple rectangular sluice gates will set a target flow rate to the downstream portion of Lateral 31A.
3. A new 50 ft. LCW will be constructed in the left canal bank of Lateral 31A to automatically:
    a. Maintain the target water level elevation upstream of the Lateral 31A flow restart gates and the Sub-Lateral 31A-37 headgates.
    b. Spill excess flows in the level pool into the regulating reservoir.
4. The existing Sub-Lateral 31A-37 headgates will be set to pass approximately 75% of the demand flow for the sub-lateral.
5. The existing check structuring in Sub-Lateral 31A-37 just downstream of Eli Gap Road will be replaced with a new flow control structure (see Figure 30). The new structure will act as the new flow control point for the sub-lateral and have the ability to change the flow at any time.

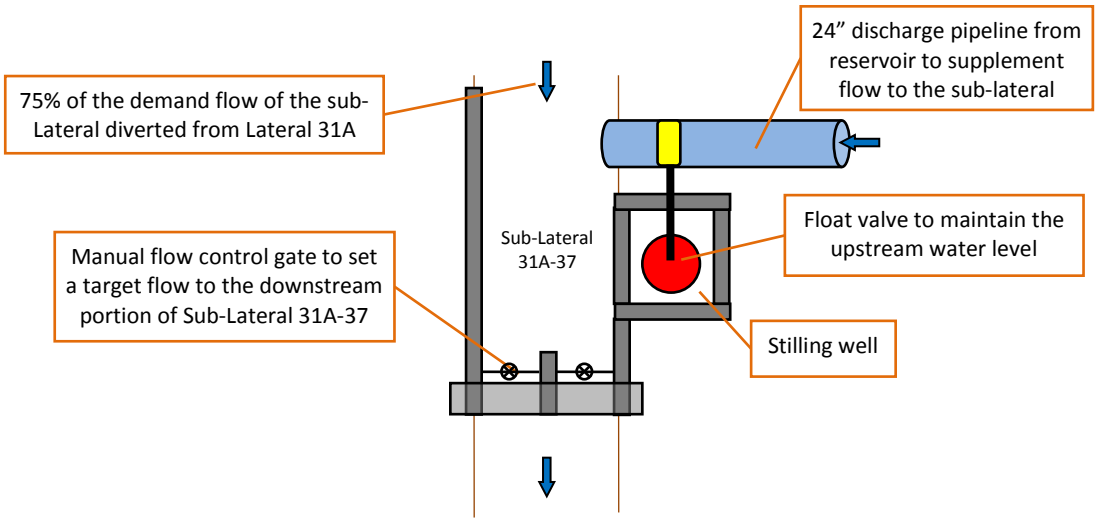

Figure 30. Conceptual plan view of new flow control in Sub-Lateral 31A-37 downstream of Eli Gap Rd. (not to scale)

6. Water in the reservoir will discharge into Sub-Lateral 31A-37 directly upstream of a new flow control structure.
    a. A new 24" diameter pipeline will convey up to 15 CFS from the reservoir to supplement Sub-Lateral 31A-37.
    b. The discharge from the reservoir will be regulated by a float valve installed at terminus of the 24" diameter reservoir discharge pipeline.
    c. The float valve will maintain a fairly constant water level upstream of new flow control point for Sub-Lateral 37A-37. The control scheme of the float valve will be as follows:

   i. If the water level upstream the new flow control structure drops below the target water level elevation, the float valve will automatically open to discharge more flow into the sub-lateral.
   ii. If the target water level elevation in the sub-lateral is exceeded, the float valve will automatically close down, preventing any discharge from the reservoir into the sub-lateral.
7. An emergency spill in the reservoir will automatically spill water to a nearby drain if the maximum water elevation in the reservoir is ever exceeded.
8. A new flow measurement flume will be constructed in Sub-Lateral 31A-37 downstream of the new flow control structure to measure the target flow rate.
   a. The flow rate will be remotely monitored via SCADA.
   b. A 300 ft. section of canal section of Sub-Lateral 31A-37 will need to be straightened to improve flow conditions for the new flow measurement flume.
9. If sufficient head is available, a new flow measurement flume will be constructed in Lateral 31A downstream of the new flow control restart point. The flow rate will be remotely monitored via SCADA. If sufficient head is not available, then the rectangular sluice gates used to measure the diverted flow rate by:
   a. Measuring the headloss across the gates.
   b. The net opening of each gate. Each gate will be opened the same amount.

Improved Water Level Control along Lateral 31A

The existing water level control structures along Lateral 31A in the Valley View Canal System are typically multi-bay or single bay flashboard structures (see Figure 31 for several examples). The existing structures are not adequate for handling frequent flow rate changes while maintaining a fairly constant water level. When a large flow rate change is made, operators have to "chase" the water down the canal, adjusting the flashboards for each structure.

Figure 31. Examples of existing check structures along Lateral 31A

By replacing existing check structures with either LCWs or flap gates for improved water level control, the following benefits will be achieved:

- The upstream canal water level will be maintained fairly constant over a wide range of flow rates. This will result in a more constant flow rate through lateral and turnout headgates.
- The recommended water level control structures need little to no manipulation from operators during the irrigation season. Operators will be able to spend more time managing farmer turnout deliveries rather than managing the canal.
- Flow rate changes made at the canal head will be able travel downstream faster.

Figure 32 shows the approximate locations for improved water level control along Lateral 31A. The first ten existing check structures between the lateral head and the regulating reservoir will be improved to create a "superhighway". The idea of a canal "superhighway" is that operators can change flows into the canal, and to all turnouts, without having to move up and down the canal and make adjustments to any canal structures or other turnouts.

Table 1 contains the list of each improved water level control structure.

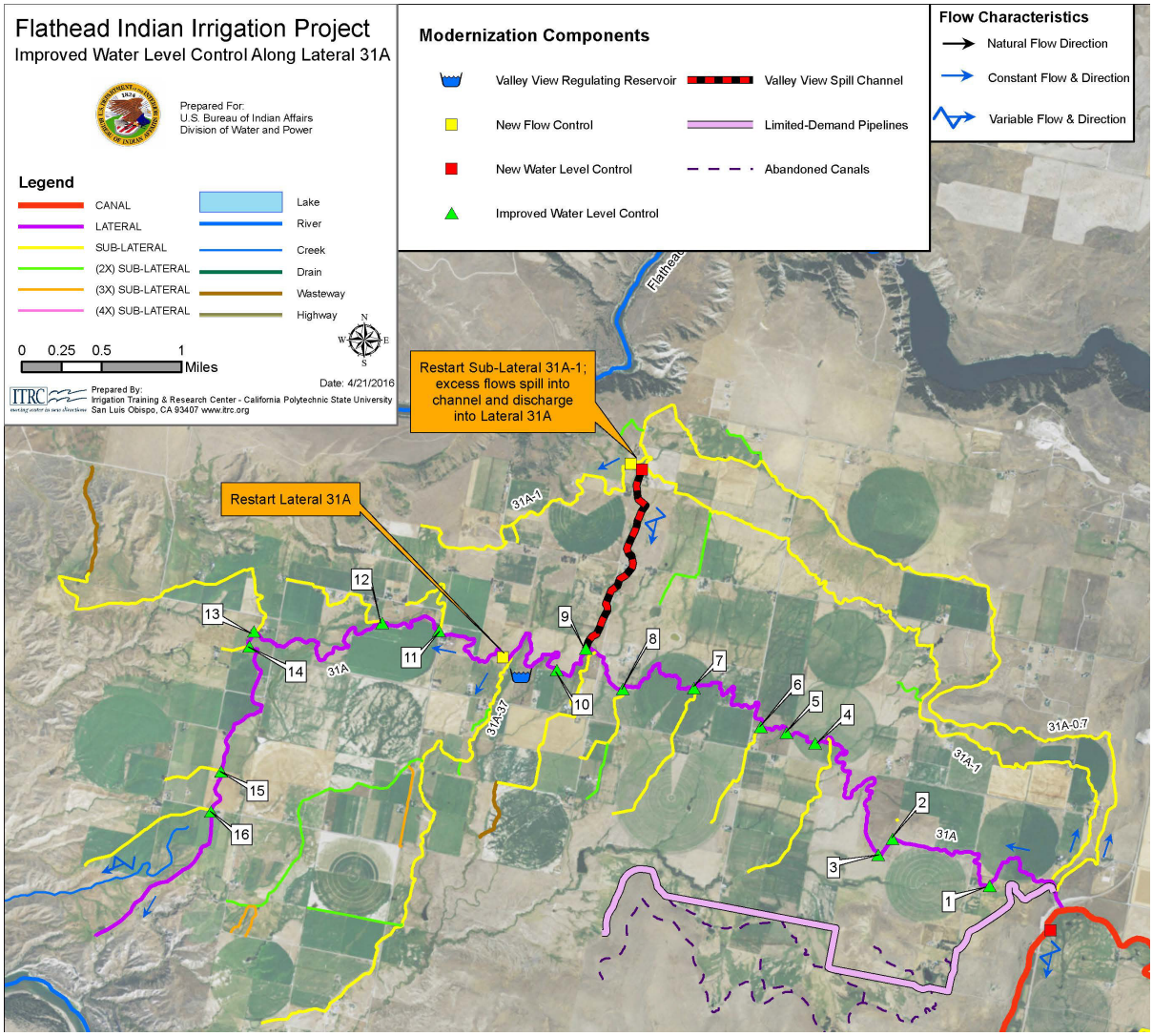

Figure 32. Locations of improved water level control along the Lateral 31A superhighway in the Valley View Canal System

Table 1. List of new or improved water level control structures along Lateral 31A

No.	Longitude	Latitude	Structure Type[1]	Design Length (ft.)	Priority
1	-114.2068	47.6233	FG	--	High
2	-114.2207	47.6258	FG	--	High
3	-114.2221	47.6242	LCW	30	High
4	-114.2332	47.6330	LCW	30	High
5	-114.2372	47.6335	LCW	30	High
6	-114.2407	47.6336	LCW	30	High
7	-114.2504	47.6359	LCW	30	High
8	-114.2597	47.6346	LCW	30	High
9	-114.2655	47.6375	LCW	30	High
10	-114.2688	47.6351	LCW	30	High
11	-114.2852	47.6365	FG	--	Low
12	-114.2928	47.6362	LCW	20	Low
13	-114.3093	47.6333	FG	--	Low
14	-114.3095	47.6318	FG	--	Low
15	-114.3100	47.6202	FG	--	Low
16	-114.3103	47.6164	FG	--	Low

[1] FG = Flap Gate LCW = Long-Crested Weir

Sub-Lateral 31A-0.6 Limited-Demand Pipeline

Sub-Lateral 31A-0.6 appears to be fairly difficult to manage for the following reasons:

- The canal is fairly long, winding, and runs along a steep hill.
- There are many turnouts that service very little acreage.
- Any operational spill appears to be lost to the project.

It would be in the project's best interest to convert the entire alignment of Sub-Lateral 31A-0.6 to a new limited-demand pipeline as shown in Figure 33. The benefits would include:

- Improved service to the farmers
- Easier management for operators
- Elimination of seepage and operational spills

Not enough time was allowed to complete a design for the proposed pipeline. Further investigation will be needed to determine if there is a cost benefit to constructing the new pipeline.

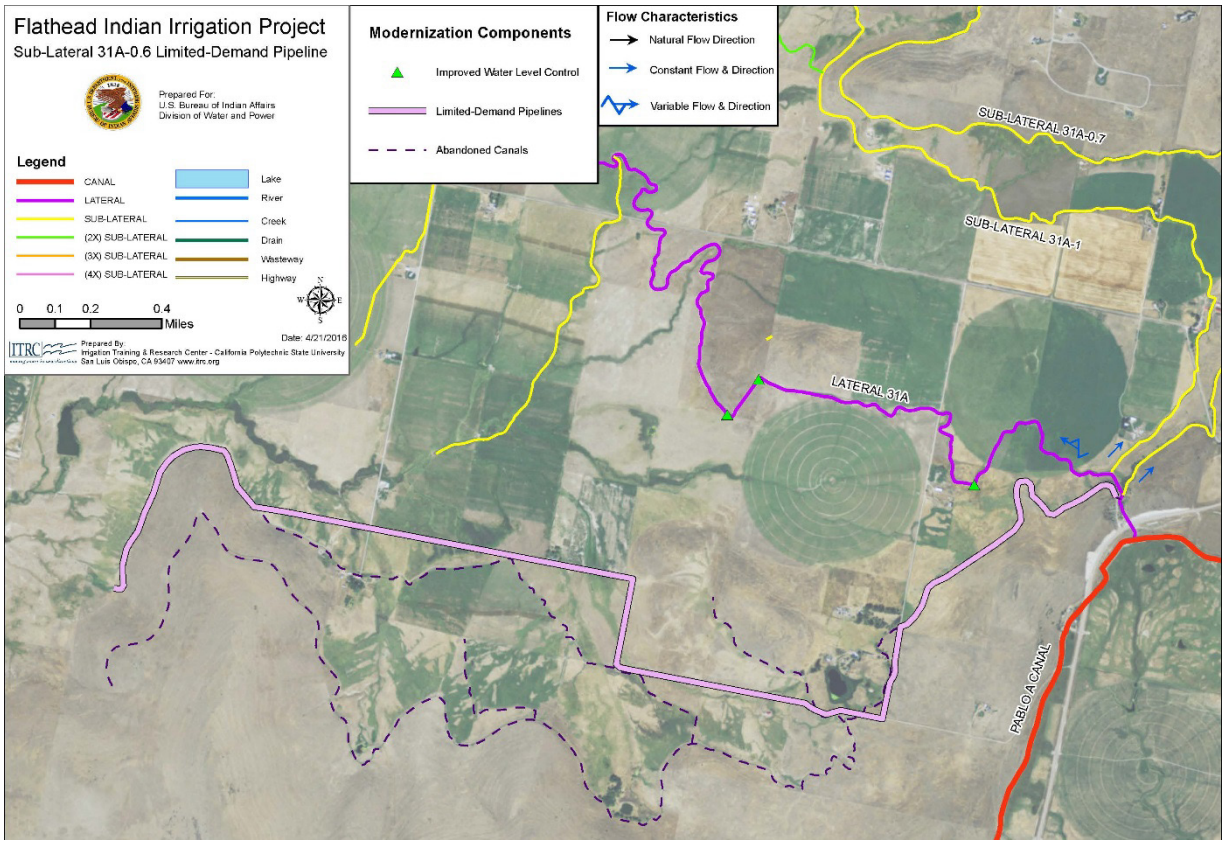

Figure 33. Possible alignment of a new limited-demand pipeline to service Sub-Lateral 31A-0.6

Improvements along Sub-Lateral 31A-0.7 and 31A-1

Previous report sections discussed the new "restart" point and spill in Sub-Lateral 31A-1. Figure 34 shows additional improvements to be made along Sub-Lateral 31A-0.7 and 31A-1. The two additional improvements include:

1. Reduce canal seepage along the entire alignment of both sub-laterals via vibratory compaction.
2. Improve the water level control at the existing check structures.

The two additional improvements are a low priority compared to other improvements to be made in the entire Valley View area. The vibratory compaction is very cheap (approximately $2/lineal ft.) and should just be performed when extra funds are available. However, improving the existing water level control would:

- Provide better service to farmer turnouts by maintaining constant delivery flows since the water level would remain more constant. Increased flexibility will be provided to the turnouts since extra flow will be diverted into both sub-laterals to ensure that there is always spill at the new "restart" point on Sub-Lateral 31A-1.
- Management of the two laterals would be easier for operators since they will not have to worry about manipulating the existing check structures for maintaining water levels.
- Both sub-laterals will eventually operate as a "flow through" system.

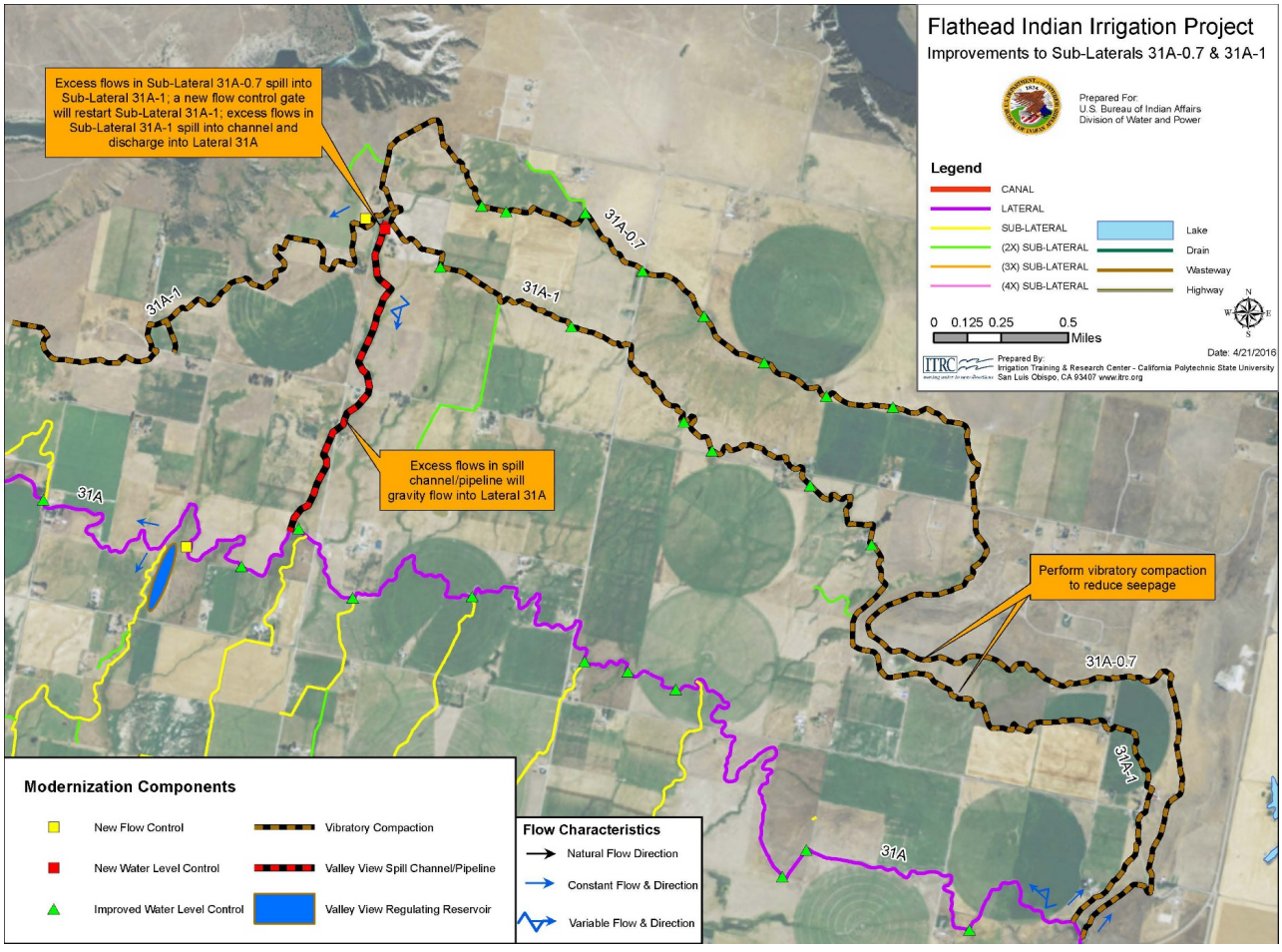

Figure 34. Improvements along Sub-Laterals 31A-0.7 and 31A-1