



North Fork Kings  
Groundwater Sustainability Agency

## **Groundwater Sustainability Plan (GSP) Status Report**

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Provost & Pritchard Consulting Group**

**BOARD OF DIRECTORS MEETING**

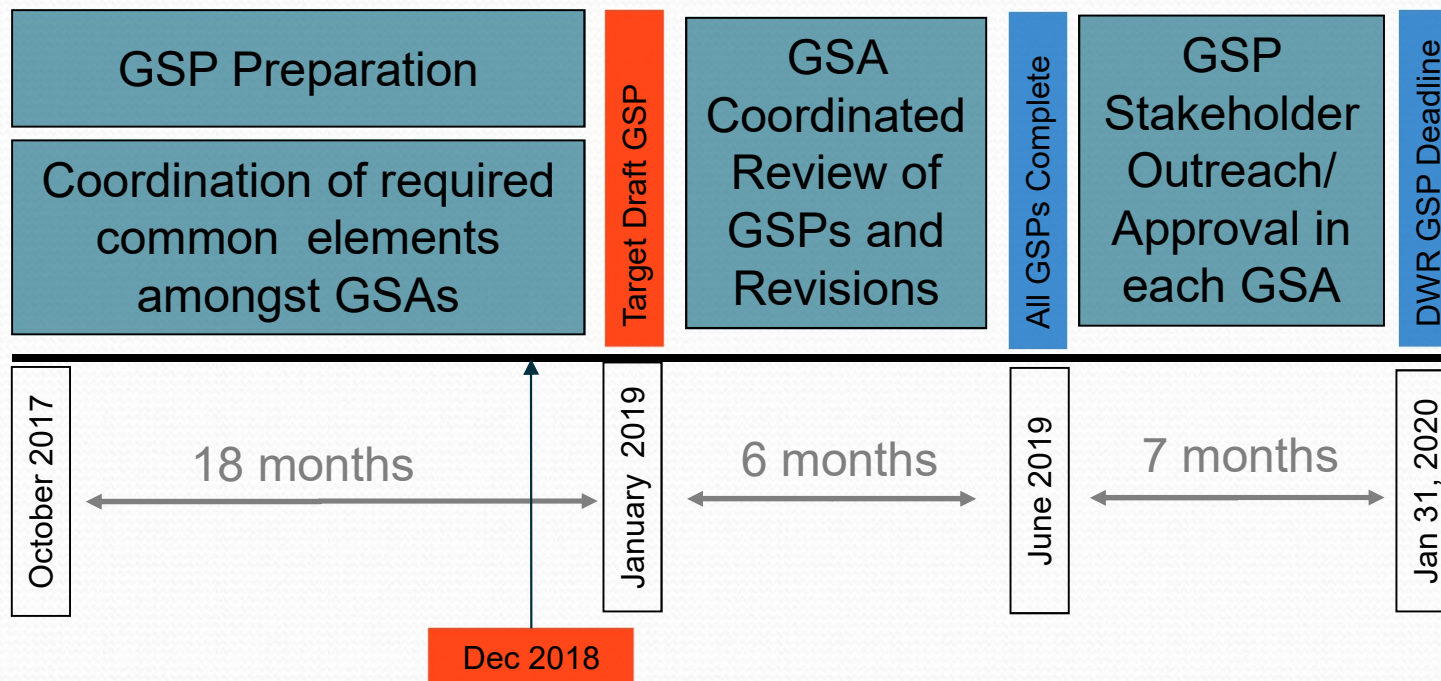
**DECEMBER 5, 2018**

**RIVERDALE COMMUNITY EDUCATION CENTER**



## Presentation Overview

1. Schedule
2. Stakeholder Survey
3. Kings Subbasin Coordination Update
4. Achieving Sustainability
  - Potential Projects
  - Management Actions
  - Undesirable Results
5. Monitoring Network
6. Water Quality Characteristics
7. Interconnected Surface Water



**GSP Preparation and Coordination Timeline**



# Stakeholder Survey on North Fork Kings GSA website

<http://northforkkings.org/>



## STAKEHOLDER SURVEY

Thank you for agreeing to take part in this important survey to help the North Fork Kings GSA Board better understand the priorities of those who have a stake in groundwater management in the North Fork Kings Groundwater Sustainability Agency service area. We would like to gain your thoughts and opinions in order to better serve all users of groundwater in the North Fork Kings area. This survey should take 4-5 minutes to complete. Your responses are confidential. All responses will be compiled together and analyzed as a group.

1. **How important are the following uses of water to you personally?** Please rank the categories with 1 being the most important use of water and 6 being the least important.

\_\_\_\_\_ *Municipal*

\_\_\_\_\_ *Mining/Petroleum*

\_\_\_\_\_ *Agricultural*

\_\_\_\_\_ *Manufacturing*

\_\_\_\_\_ *Recreational*

\_\_\_\_\_ *Wildlife/Fisheries*

2. **How important are the following uses of water to the region?** Please rank the categories with 1 being the most important use of water and 6 being the least important.

\_\_\_\_\_ *Municipal*

\_\_\_\_\_ *Mining/Petroleum*

\_\_\_\_\_ *Agricultural*

\_\_\_\_\_ *Manufacturing*

\_\_\_\_\_ *Recreational*

\_\_\_\_\_ *Wildlife/Fisheries*

3. **Please rank the categories with 1 being the most important for reason for managing groundwater and 5 being the least important.**

\_\_\_\_\_ *Ensure drinking water supply for domestic uses*

\_\_\_\_\_ *Ensure water supply for future generations*

\_\_\_\_\_ *My ability to earn a living is directly linked*

\_\_\_\_\_ *Provide reliable water for industry/business*

\_\_\_\_\_ *Future economic growth for region*

\_\_\_\_\_ *Other* \_\_\_\_\_

## Stakeholder Survey questions, cont.



### STAKEHOLDER SURVEY

4. **How knowledgeable do you consider yourself of local water issues?**
5. **How knowledgeable do you consider yourself of the new groundwater regulation, the Sustainable Groundwater Management Act?**
6. **Are you currently engaged in activity or discussions regarding groundwater management in your area?**
7. **How important to you is information on anticipated impacts of new state regulations.**
8. **Which format or formats would you prefer for receiving information about groundwater management planning process? (Check all that apply)**
9. **Which applies to you? I am a stakeholder representing pumping for... (Check all that apply)**
10. **Which best describes the community in which you or your industry/business resides? (Circle all that apply)**
11. **Please indicate your age range? (Circle one)**

Thank you for taking the time to complete the survey. If you and/or others in your organization would like to receive updates and information on groundwater management in the North Fork Kings area, please provide your e-mail contact information below to be added to our Interested Persons list. You may also sign-up to join our Interested Persons list by filling out our online form at [northforkkings.org](http://northforkkings.org).

First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_ E-Mail: \_\_\_\_\_

## Kings Subbasin Coordination Task Orders

All GSAs within Kings Subbasin working together to estimate current overdraft responsibility among GSAs and coordinate activities:

Task 1 - project coordination and meetings

Task 2 - groundwater conditions

Task 3 - estimation of groundwater storage (unconfined)

Task 4 - groundwater flow estimates

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Task 5 - confined aquifer boundary flow estimate

Task 6 - data management system

Task 7 - water budget

Task 8 - DWR Technical Support Services Coordination

Task 9 - Coordination Agreement Assistance

Task 10 - Water Level Sustainable Management Criteria Coordination





## **Kings Subbasin Coordination Update**

- Evaluated several potential base periods to estimate “average” conditions for surface water deliveries, with assumed “average” groundwater pumping
- Evaluated different methodology alternatives with several iterations to allocate responsibility for groundwater overdraft
- Calculated historical storage change and impacts of groundwater flows
- Preliminary estimate of groundwater overdraft for NFKGSA is approximately 50,000 AF/yr
- Group acknowledges the numbers will change as additional information is obtained and will be re-evaluated in the future
- Kings coordination group working on remaining task order items



## Achieving Sustainability

- Preliminary estimate of groundwater overdraft for NFKGSA is approximately 50,000 AF/yr
- There are basically only two ways to achieve sustainability and eliminate overdraft:
  - Increase water supply - primarily through project development
  - Reduce water demand – primarily through management actions
- Increasing water supply will be the emphasis, but there are hurdles:
  - Availability and frequency of additional water – likely Kings River floodwater – for groundwater recharge or direct use
  - Water rights – all Kings River water is allocated per established schedule
  - Physical constraints – soils conducive for recharge, distribution system, etc.
- Demand reduction will likely be initiated after 5 years if project development isn't progressing as needed to increase water supply



## Potential Projects

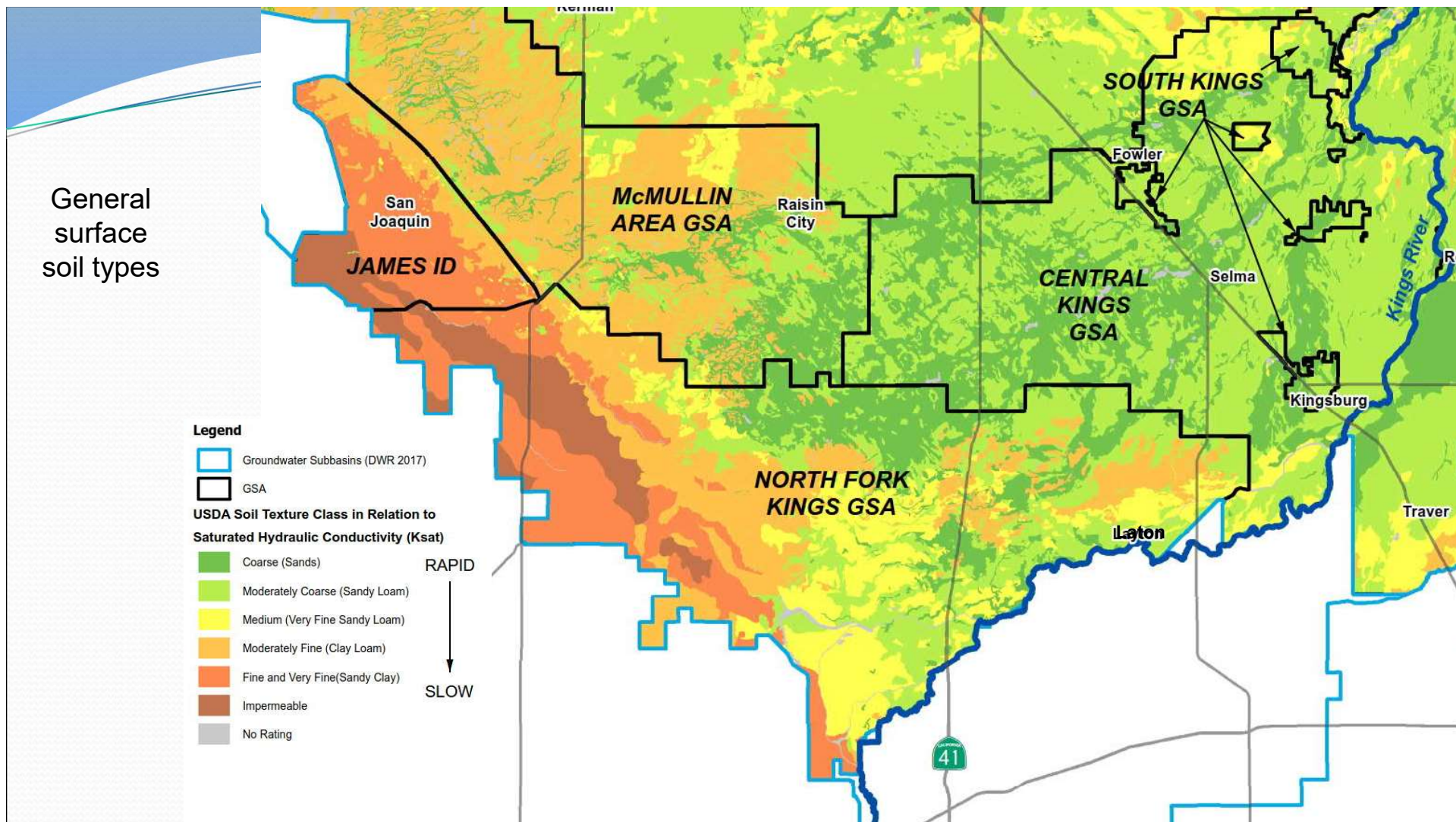
### Potential Recharge Projects

#### Example - For Illustrative Purposes Only

NFKGSA Conceptual Estimate of Required Groundwater Recharge to offset calculated overdraft

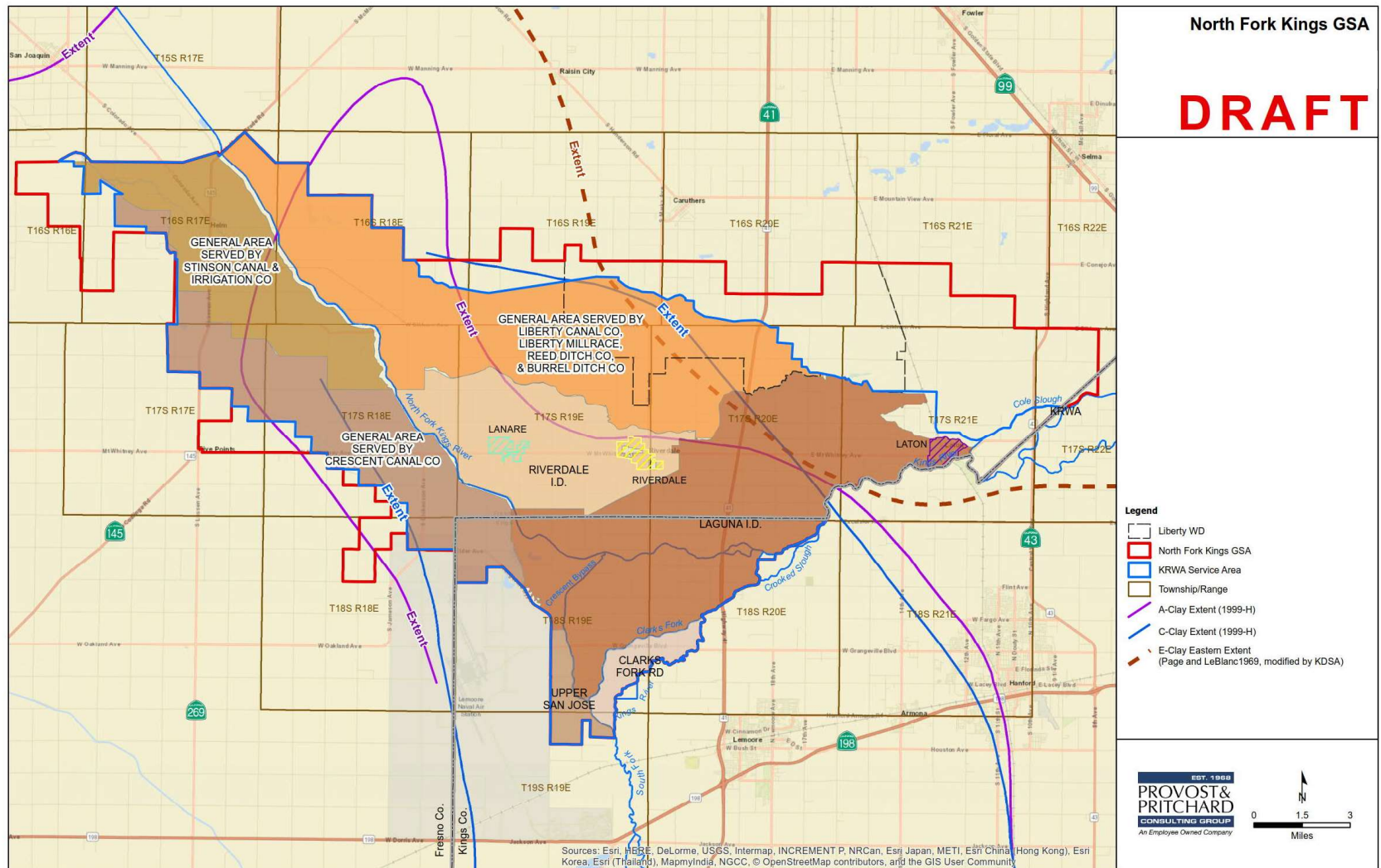
Average annual NFKGSA overdraft	50,000	AF/yr (preliminary)
Avg frequency of Kings River flood flows	33%	1 out of 3 years
Recharge needed during flood release	150,000	AF
Average duration flood release	100	days
Daily recharge needed	1,500	AF/day
Floodwater to be captured	750	cfs
Assumed avg. recharge rate (infiltration)	0.5	ft/day
Net recharge acres needed	3,000	acres

- Preliminary project list contains 9 groundwater recharge projects that would yield an estimated annual average of approx. 20,000 AF/yr
- Additional projects have been envisioned, but additional information is needed, such as:
  - Locating restrictive clay layers
  - Reverse flow tile system
- The amount of overdraft that can't be overcome with increasing the water supply will need to be overcome with management actions that reduce water demand



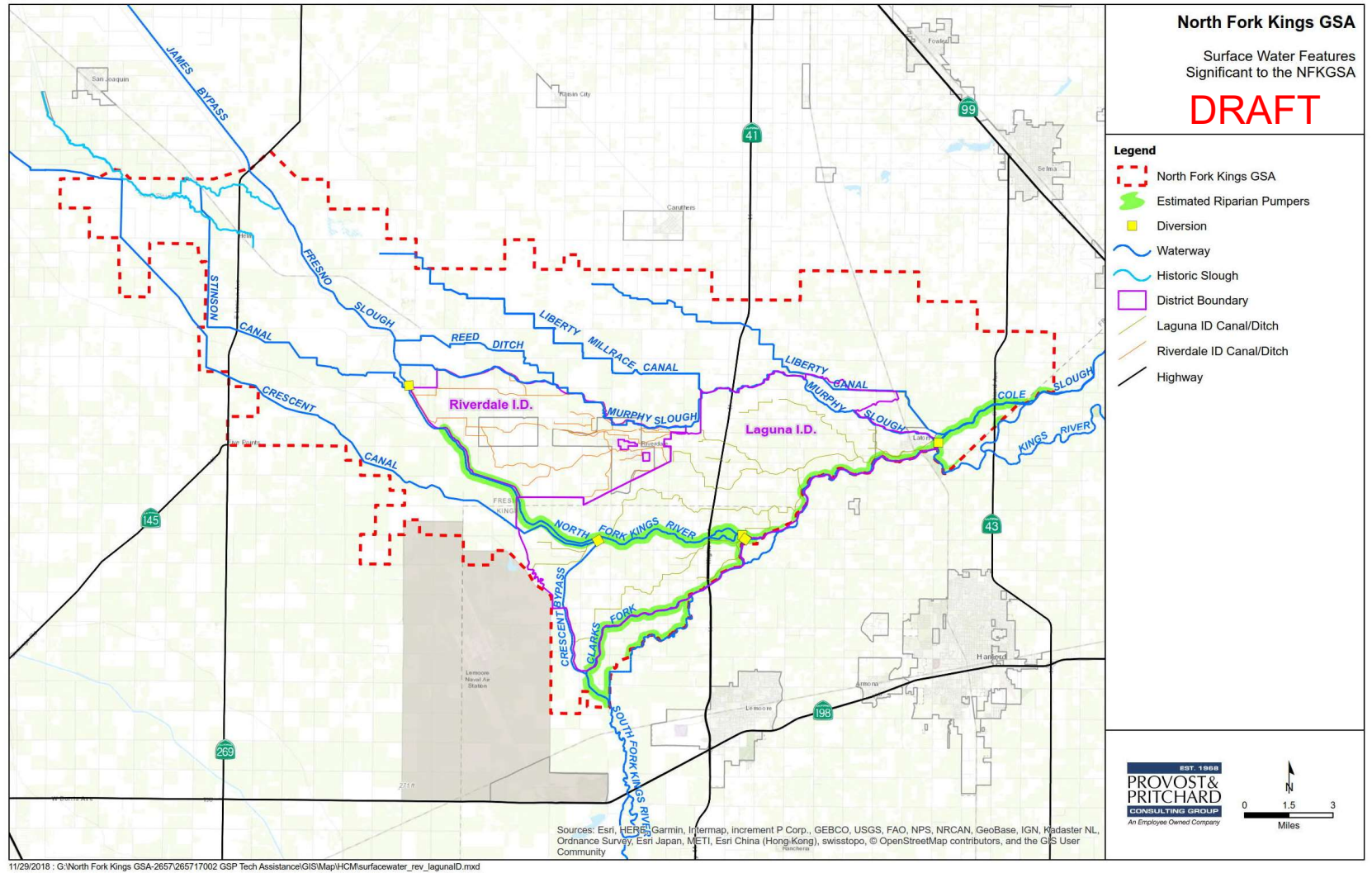


# General Surface Water Delivery Areas





# Major canals and conveyance system



## Potential Management Actions

- Management Actions are programs and policies that will aid the GSA in achieving sustainability primarily through water demand reduction measures and improving data monitoring
- A suite of potential management actions will be presented in the GSP that could be implemented at the GSA level or landowner level
- GSA may not want to dictate management actions at the landowner level, what works for one landowner may not work for another
- While the GSA and subbasin needs to attain sustainability by 2040, economic impacts must be considered
  - As someone once said “*Farming without profits is just gardening*”
- Determine the schedule for program and policy implementation and potential circumstances which would trigger implementation of programs and policies
- Establish the the criteria and response to exceedances of minimum thresholds and undesirable results

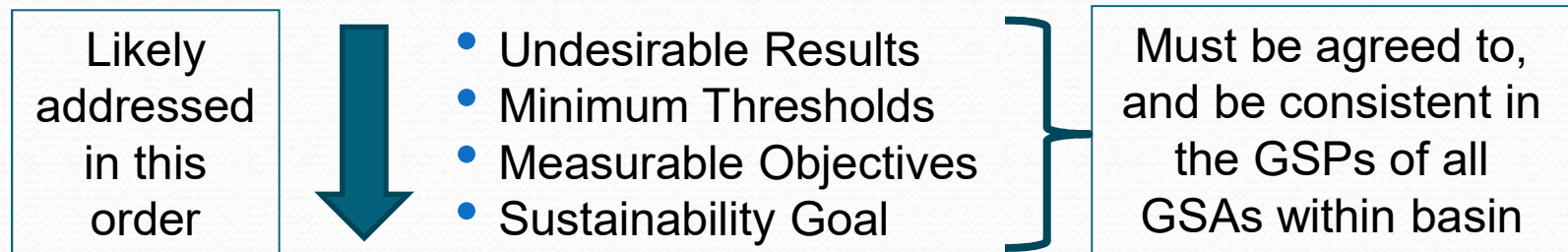


## Sustainable Management Criteria

- Sustainability indicators



- Significant & Unreasonable – defined using the following:



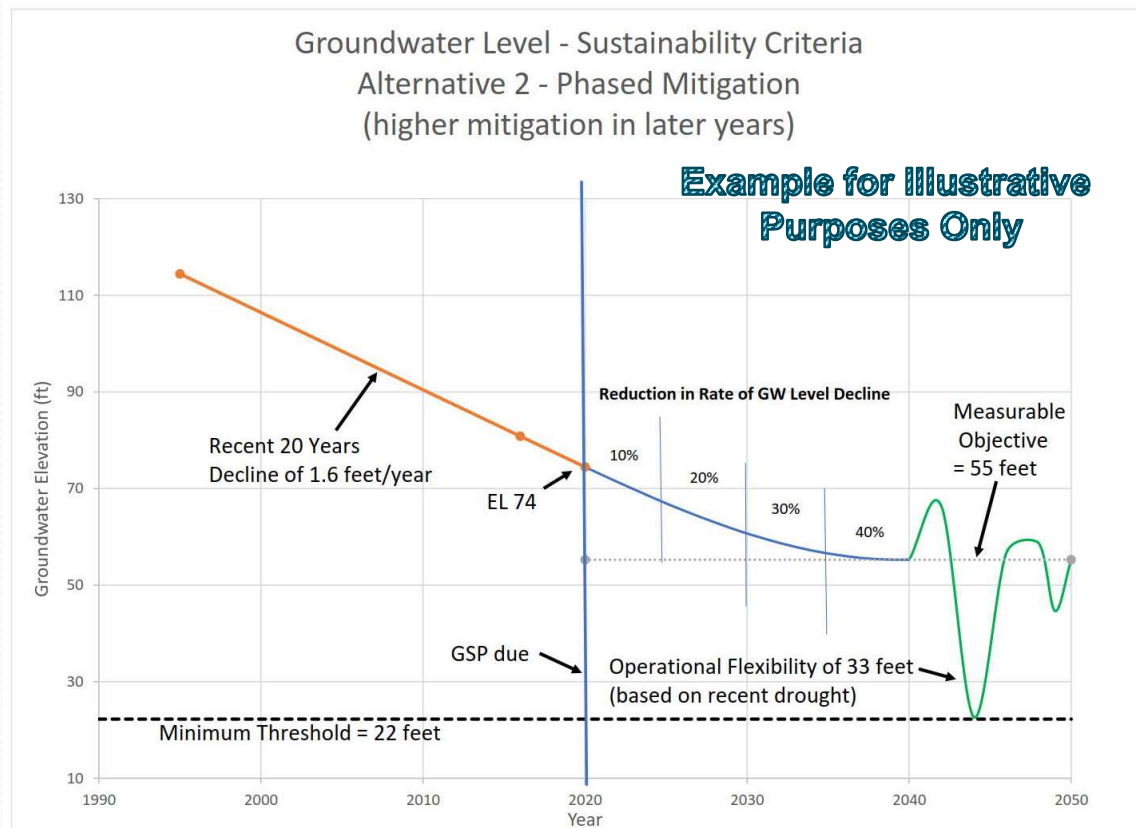




## Undesirable Results

- Undesirable results occur when conditions related to any of the six sustainability indicators become significant and unreasonable
- Undesirable results will be used by DWR to determine whether the sustainability goal has been achieved within the basin
- Undesirable results will be defined by minimum threshold exceedances
  - at a single monitoring site, multiple sites, portion of basin, entire basin
- GSP must include a description for each undesirable result and define when an undesirable result is triggered
- Descriptions of undesirable results are to be coordinated with other GSAs within a basin

## Proposed phased mitigation



- May be most practical, realistic approach
- Higher mitigation in later years
- Establish Minimum Threshold to avoid conditions that are significant and unreasonable
- Phased mitigation is needed due to early delays in building projects (funding, permitting, design) and availability of flood water for recharge

## Possible Undesirable Results

<b>Sustainability Indicators -&gt;</b>	<b>Lowering of Groundwater Levels</b>	<b>Groundwater Storage Reduction</b>	<b>Degraded Water Quality</b>	<b>Land Subsidence</b>	<b>Surface Water Depletion</b>
<i>Metric -&gt;</i>	Groundwater elevation of wells	Volume withdrawn from an area	Water quality measurements	Rate and extent of land subsidence	Rate or volume of surface water depletion
<b>Undesirable Results</b>	Shallow supply wells go dry (mostly domestic)	Reduces reserve available for droughts	Contaminant plume migration	Interferes with surface land uses	Stream depletion
	Increased pumping costs for supply wells	Avail water less than operational flexibility	Additional treatment and monitoring costs	Infrastructure damage – roads, pipelines, canals	GW Dependent Ecosystem impacts
	Rehab costs (ex: deepen wells, lower pumps)		Potential inability to use supply wells	Supply well damage	Riparian Impacts
	Adversely change GW flow gradients		Impact on crop yields	Arsenic squeezed out of clays?	
	Causes land subsidence		Human health impacts	Reduces conveyance systems capacities	
	Adversely impacts water quality		Reduces available supply of water	Increased seepage and flooding risks	
	Stream depletion				
Groundwater elevation may be used as a proxy metric for all sustainability indicators.					

**Must define going forward when these undesirable results become significant and unreasonable as a result of groundwater management actions.**



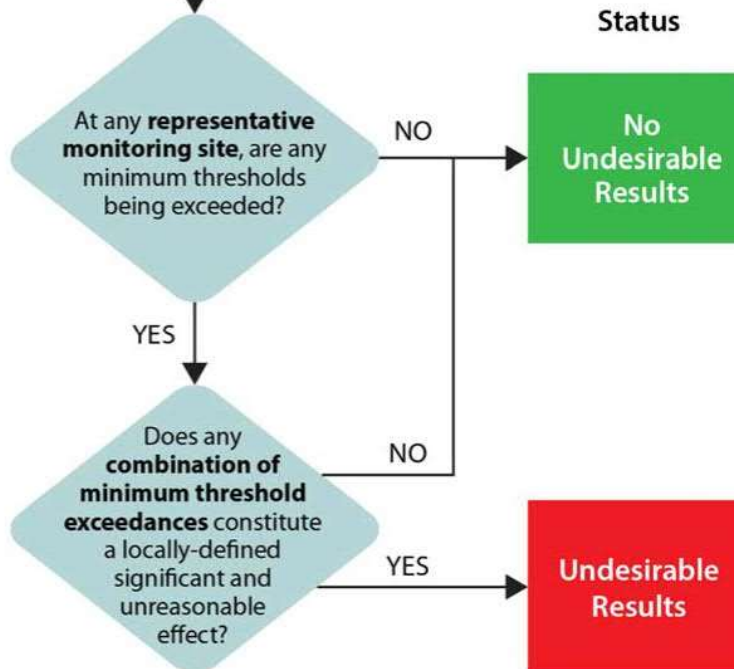
## Relationship between Sustainability Indicators and Undesirable Results

### Sustainability Indicators



### Apply Sustainable Management Criteria

- Review data
- Consider beneficial uses and users of groundwater
- Review specific metrics for each sustainability indicator



### Status

No Undesirable Results

Undesirable Results

## Potential Projects and Programs for Mitigating Groundwater Overdraft

**DRAFT 10-30-2018**

No.	Category	Description	Supply (S) or Demand (D) side action	Estimated Time to Potential Implementation (years)		
1	Conjunctive Use	Groundwater Recharge <ul style="list-style-type: none"> <li>○ Recharge basins</li> <li>○ Grower reservoirs</li> <li>○ Unlined canals</li> <li>○ Reverse tile drains</li> <li>○ Dry wells</li> <li>○ Injection wells</li> <li>○ Reclaimed water</li> </ul>	S	0 - 1	1 - 5	
2		Groundwater Banking	S		1 - 5	
3		Intentional Irrigation Field Flooding	S	0 - 1	1 - 5	
4	Surface Water	Direct Use of Flood and Storm Water	S	0 - 1	1 - 5	
5		Import New Surface Water Supplies	S		1 - 5	
6		Increase Surface Water Storage	S			>5
7		Increase Conveyance Capacity	S		1 - 5	
8		Fully Utilize Surface Water Allocation	S	0 - 1		
9		Internal Surface Water Trading	S	0 - 1		
10		Take or Pay Pricing Structure	S	0 - 1		
11		Low Surface Water Pricing	S	0 - 1		

## Potential Projects and Programs for Mitigating Groundwater Overdraft

**DRAFT 10-30-2018**

No.	Category	Description	Supply (S) or Demand (D) side action	Estimated Time to Potential Implementation (years)		
12	Land Management	Agricultural Land Conversion <ul style="list-style-type: none"> <li>○ Sell/lease land and reserve groundwater rights</li> <li>○ Fallow feed crops and purchase feed (at dairies)</li> <li>○ Agency purchases and fallows land from willing landowners</li> <li>○ Fallow land and flood fields/build recharge basins</li> <li>○ Develop habitat for water storage or recharge</li> </ul>	D	0 - 1	1 - 5	
13		Expand Districts/Form New Districts	S		1 - 5	
14		Crop Conversion (salt tolerant or low water use)	D	0 - 1		
15		Deficit Irrigation	D	0 - 1		
16		Urban Land Use Regulations	D	0 - 1		
17		Subsidies / Incentivize <ul style="list-style-type: none"> <li>○ Land fallowing</li> <li>○ Crop rotation</li> <li>○ Crop conversion</li> </ul>	D		1 - 5	
18		Add disclaimer on property purchases	D	0 - 1		
19		Mandatory land fallowing	D	0 - 1		
20		Prohibition on land development unless proven water supply	D	0 - 1		



## Potential Projects and Programs for Mitigating Groundwater Overdraft

**DRAFT 10-30-2018**

No.	Category	Description	Supply (S) or Demand (D) side action	Estimated Time to Potential Implementation (years)		
21	Groundwater Use Restrictions	Prohibit Groundwater Exports	S	0 - 1		
22		Groundwater Metering and Pumping Restrictions	D	0 - 1		
23		Additional Well Permit Requirements <ul style="list-style-type: none"> <li>o Flow meter with ac-ft totalizer</li> <li>o Sounding tube for water level</li> <li>o Prohibition of composite wells</li> </ul>	D	0 - 1		
24		Moratorium on new well permits	D	0 - 1		
25	Water Conservation	Water Use Restrictions	D	0 - 1		
26		Agricultural Water Conservation	D	0 - 1		
27		Urban Water Conservation	D	0 - 1		
28		Industrial Water Recycling	S		1 - 5	
29		Urban Water Recycling	S			>5
30		Agricultural Water Recycling	S		1 - 5	
31		Water Conservation Credits	D	0 - 1		
32		Tiered Pricing / Fines for Overuse	D	0 - 1		
33		Groundwater Pumping Fees	D	0 - 1	1 - 5	
34		Wellhead Fees (annual or new wells)	D	0 - 1		

## Potential Projects and Programs for Mitigating Groundwater Overdraft

**DRAFT 10-30-2018**

No.	Category	Description	Supply (S) or Demand (D) side action	Estimated Time to Potential Implementation (years)		
35	Other	Water Desalination <ul style="list-style-type: none"> <li>o Saline aquifer water</li> <li>o Treat agricultural drainage water instead of disposal</li> </ul>	S		1 - 5	
36		Blend Poor and Good Quality Waters	S		1 - 5	
37		Use Produced Water (from oil wells)	S		1 - 5	
38		Establish groundwater allocation	N/A	0 - 1		
39		Groundwater credit system	N/A	0 - 1		
40		Water Marketing / Trading	N/A	0 - 1		
41		Rainwater Harvesting	S		1 - 5	
42		Public Education	D	0 - 1		



## Groundwater Monitoring

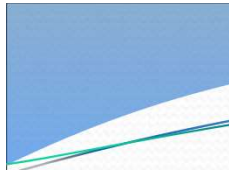
- Representative Monitoring – frequency & density
- Monitoring required to assess impacts on undesirable results
- Desirable to select minimum of 2 wells/Township if possible
- May need more wells in some areas because of variability with multiple aquifers
- Representative well density may not be met in some Townships – becomes a data gap
- Sub-areas may define different minimum thresholds and be operated to different measurable objectives
- Undesirable results must be defined consistently throughout the subbasin





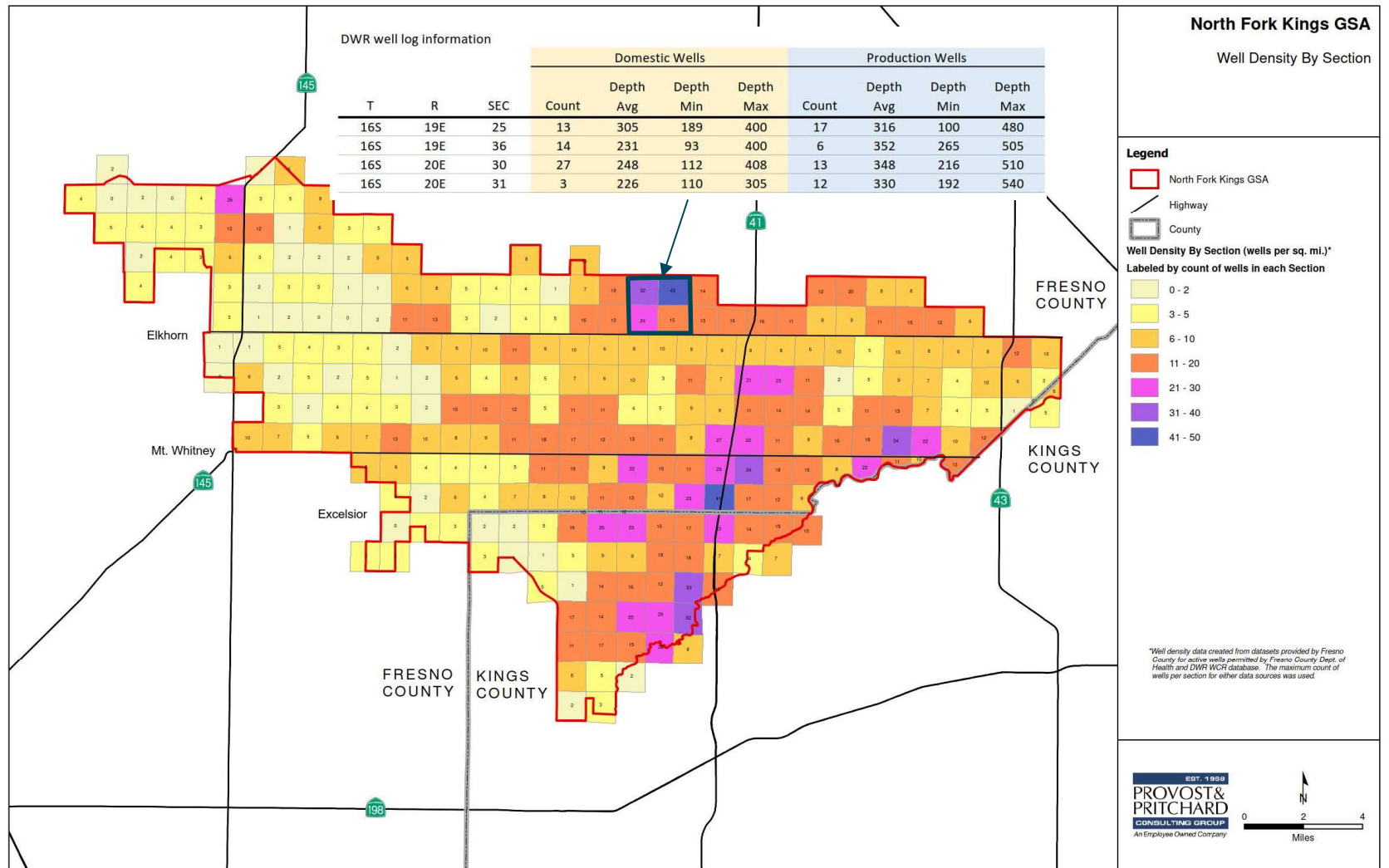
## Groundwater Monitoring

- Adequate monitoring requires knowledge of well depth and perforated interval in wells – need to know what aquifer well is pumping from
- Effort continues to obtain and match up DWR Well Completion Reports
- If unable to determine all information for Monitor Well Network, then identify data gap and commit to following:
  - Install monitoring well, ideally nested well cluster if multiple aquifers; or
  - Video existing well with monitoring history to determine construction
- Maintain other wells currently being measured – still useful
- Construct as many monitor wells through DWR TSS grant as possible
- Will need to construct some shallow monitor wells along river system to fully assess surface water-groundwater interaction



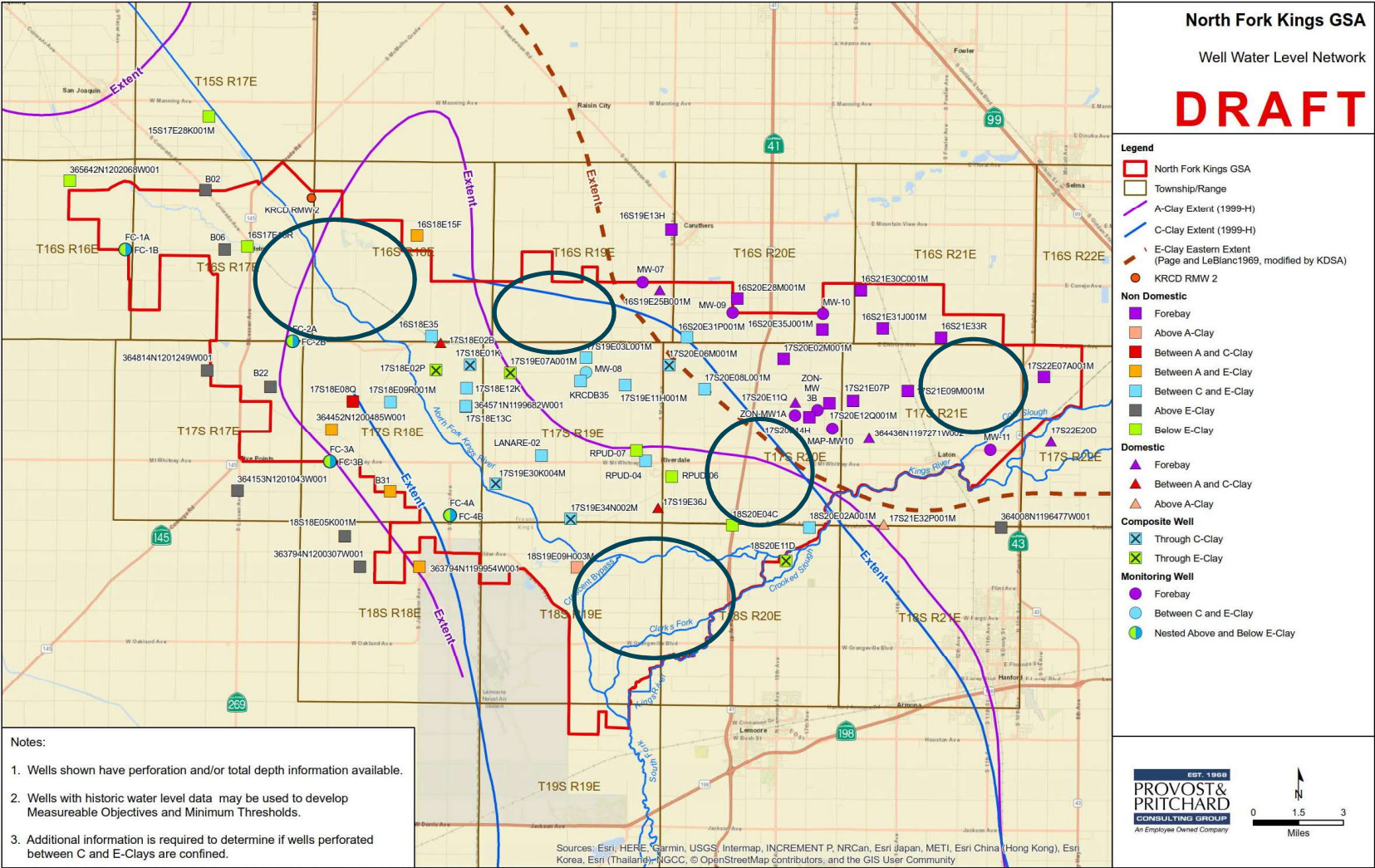
Representative  
Well Density

Evaluating well  
depth  
information



Update  
Draft  
Monitoring  
Network

Identified  
Data Gaps

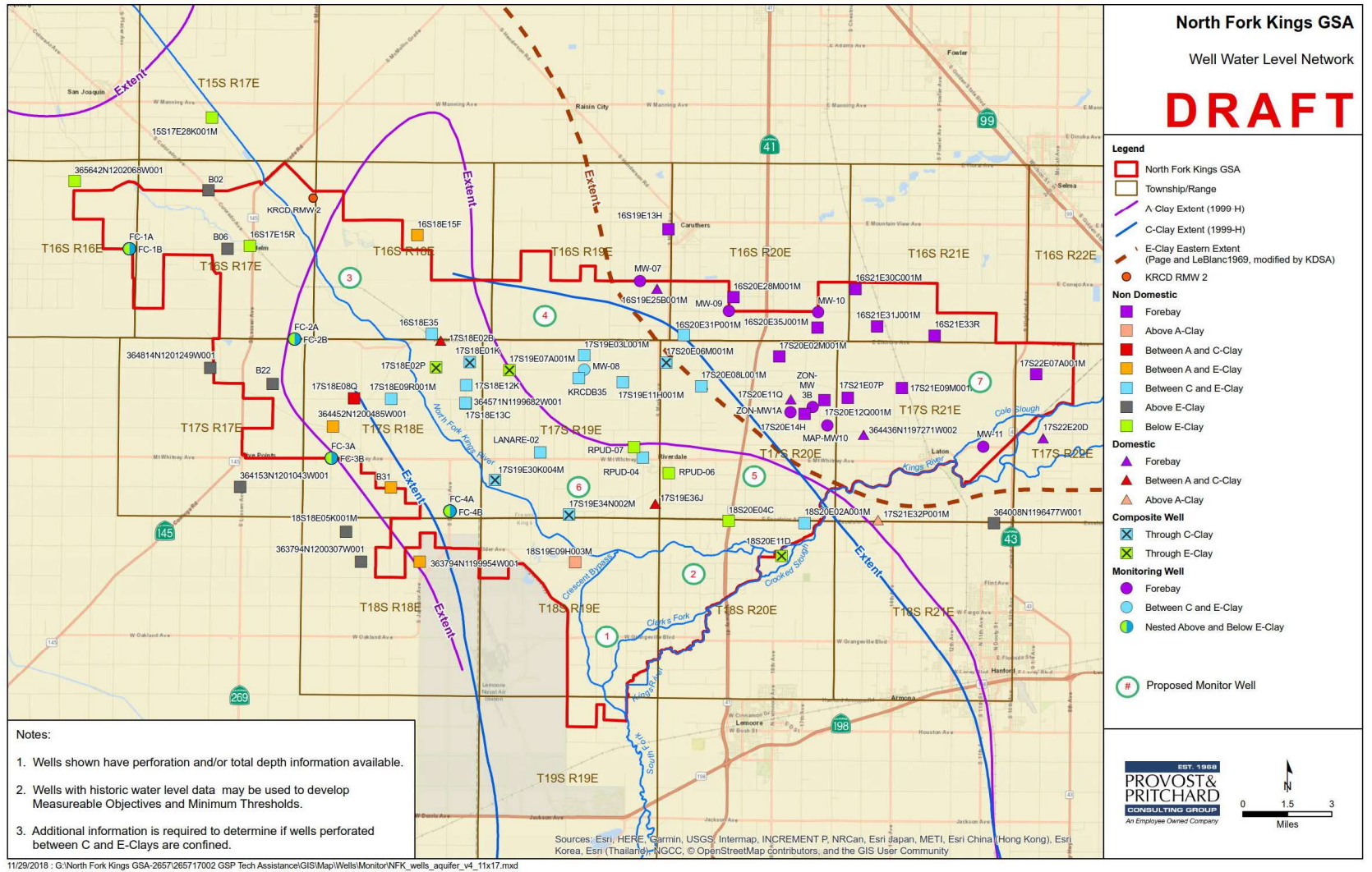


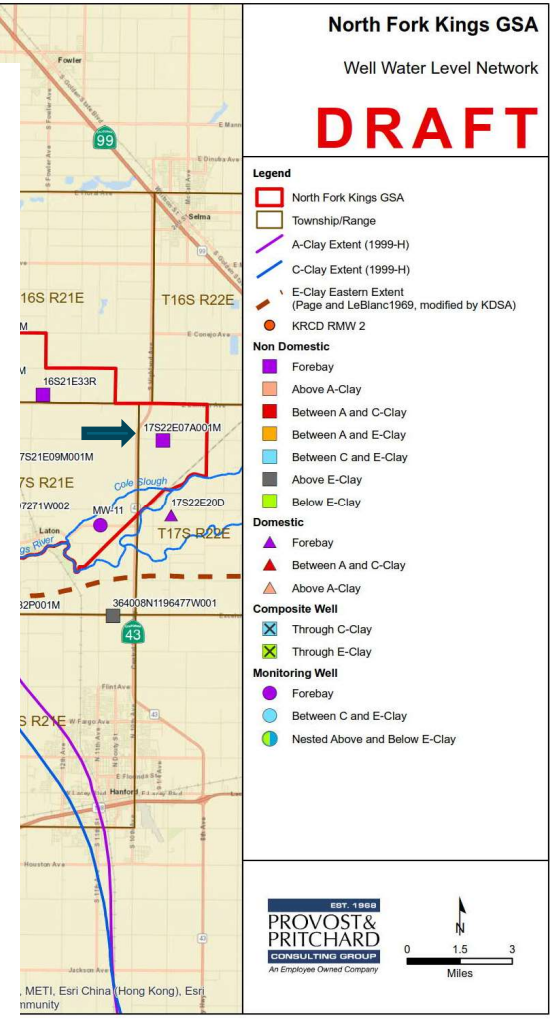
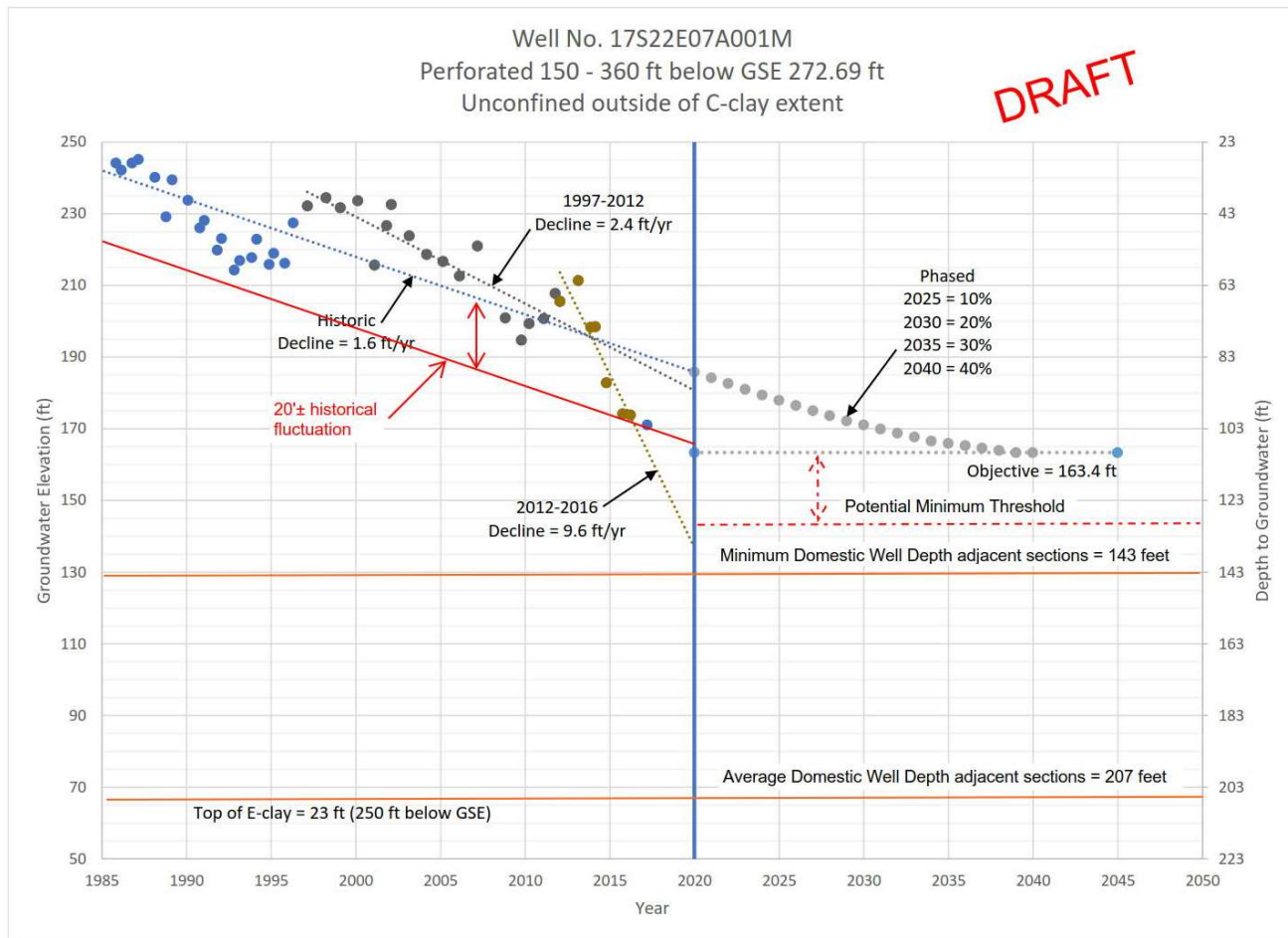




Draft  
Monitoring  
Network

Proposed  
Dedicated  
Monitor  
Wells









## **Water Quality Characterization**

- Water Quality is one of the sustainability indicators that will be considered when setting minimum thresholds
- In process of reviewing available water quality information to develop background data
- Primary data source is USGS reports as part of groundwater ambient monitoring assessment (GAMA) program
- Other data sources also being reviewed, including some publicly available potable water source information
- Identifying construction well data to separate data by aquifer zone
- In process of comparing water quality trends in areas where periodic sampling has occurred, comparing constituent levels that exceed maximum contamination levels and health-based screening levels





## Interconnected Surface Water

- Interconnected Surface Water is one of the sustainability indicators that will be considered when setting minimum thresholds
- Interconnected Surface Water is defined as “*surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted*”
- The Kings River can be dry within area of GSA during portions of the year
- Some shallow groundwater conditions may occur, but it is thought there is not a continuous saturated zone to the underlying groundwater aquifer
- Lack of data in area over “A” clay though – may need to install shallow monitor wells along river to verify
- Relates to Groundwater Dependent Ecosystem evaluation – are ecosystems within NFKGSA groundwater dependent or surface water dependent?



Questions?