Recharging Butte County’s Groundwater Basins

What is Recharge?
“Recharge” or “deep percolation”, is defined as the downward flow of water reaching the water table to replenish groundwater aquifers.

Why is Recharge Important in Butte County?
As inflow to the groundwater system, recharge is needed to balance outflows such as groundwater pumping or groundwater flow to streams. A variety of water sources replenish existing groundwater supplies through natural recharge processes. Groundwater is a major source of water for residents, agriculture and the environment throughout Butte County. Managing and enhancing recharge to our groundwater basins may be a very important tool in achieving sustainable groundwater levels in the four subbasins subject to the Sustainable Groundwater Management Act (SGMA) in Butte County.

What are We Doing to Understand Recharge in Butte County?
A number of studies have been conducted in recent years focused on recharge in Butte County including the Lower Tuscan Aquifer Monitoring, Recharge and Data Management Project (2013), the Butte County Stable Isotope Recharge Study (2017) and the Evaluation of Restoration and Recharge Within the Butte County Groundwater Basins report, completed in February 2018 which focused on identifying and determining the feasibility of recharge projects in groundwater subbasins subject to SGMA.

The emphasis of the 2018 report was to:
- Identify the most advantageous groundwater recharge areas in Butte County
- Evaluate surface water supplies available for managed recharge
- Provide design and implementation options for future recharge projects that may become part of SGMA Groundwater Sustainability Plans
### Natural Recharge

**Water Bodies**
Inputs to the water table from precipitation and other bodies of surface water (i.e. streams and wetlands).

**Irrigation Water**
Recharge to the aquifer from irrigation water applied to fields and from seepage during conveyance.

### Types of Recharge

**Direct Recharge**
Physical delivery of water to the aquifer through:
- Recharge basins / ponds
- Field flooding
- Aquifer Storage and Recovery (well injections)

**Indirect Recharge or In-Lieu Recharge**
Surface water use replaces groundwater use and:
- Reduces groundwater demand / use
- Improve overall supply and reliability

### Managed Recharge

**Features**
- Series of connected surface basins
- Water percolation to an unconfined aquifer system
- No seasonal or water quality regulation constraints
- Low-cost
- Existing opportunities i.e. gravel pits could be used

**Requires**
- Large, flat areas with permeable soils near surface
- Significant unsaturated depth below ponding sites
- Hydraulic connection between the ground surface and aquifers
- Routine maintenance to maintain recharge rates
- Considerable unsaturated permeable areas beyond the boundaries of the proposed area

### Considerations of Managed Recharge Approaches

**In-Lieu Recharge**

<table>
<thead>
<tr>
<th>Features</th>
<th>Requires</th>
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<tbody>
<tr>
<td>Surface water supply instead of groundwater, reducing local demand / dependence on groundwater</td>
<td>Replacement water of appropriate quantity and quality to satisfy the existing demands</td>
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<tr>
<td>Improves aquifer conditions without requiring hydraulic connection between the ground surface and the aquifer</td>
<td>Access to reliable, surface water supply of suitable quality</td>
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<td>Cost-effectiveness with use of existing infrastructure</td>
<td>Utilization of existing infrastructure</td>
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<td>No requirements to construct recharge facilities</td>
<td>Incentives for users to shift to surface water use</td>
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**Recharge Basins / Ponds**

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Where are the Best Areas for Recharging our Groundwater System?

To answer this question, a recharge analysis was conducted using mapped data layers for managed recharge approaches such as recharge basins / ponds, field flooding and in-lieu recharge using weighted criteria.

Criteria were ranked and color-coded on the maps with darker blue colors indicating more favorable areas for recharge and light green / yellow colors indicating the least favorable areas for recharge.

In the maps depicted above, the layering of different weighted data sets allows for the emergence and identification of areas that are more conducive to recharge. More specific analyses would be needed for specific projects.

To view all of the maps, criteria and rankings involved in developing the constraints maps please review the full report.
Where Could Potential Recharge Water Come From?

<table>
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<th>Existing Water Allocations</th>
<th>Local Natural Flow</th>
<th>Surface Water Use in Irrigated Agriculture</th>
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<td>Butte County holds a 27,500 acre feet / year long-term water supply contract of State Water Project stored in Lake Oroville known as “Table A Water” that could be used in-lieu of groundwater for direct recharge opportunities within Butte County. Historically, a portion of the Table A water has been used within Butte County with the unused supply being made available to south of Delta lessees.</td>
<td>Flow in local waterways could recharge the aquifer in areas where streams flow across or near areas suitable for recharge. Local stream restoration could increase base flows during low-flow periods and augment ground-water recharge. Candidate waterways include:  - Dry Creek  - Big Chico Creek  - Lindo Channel  - Little Chico Creek  - Pine Creek</td>
<td>Surface water diversions used for field irrigations instead of groundwater could provide in-lieu recharge. Dual-source irrigation systems create opportunities for increased surface water use and decreased groundwater use. Surface water use could also provide recharge during field irrigations, conveyance and other managed recharge opportunities such as recharge basins / ponds.</td>
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Key Findings

Given the high cost and long horizon for implementation of any projects described in the full report, the best short- and medium-term options make use of water now available within the County. These projects tend to be programs to encourage agricultural water users to install dual-source irrigation systems, policies to incentivize urban developers and property owners to install semi-permeable pavements and efforts to identify and advance local in-lieu recharge projects that would provide areas, now partially reliant on groundwater, access to surface water supplies from willing local partners.

The clearest opportunities for promoting groundwater recharge in Butte County lie with planning and support of recharge programs designed to improve and increase the use of water supplies now available within the County.

For more information about this Report visit https://www.buttecounty.net/waterresourceconservation/SpecialProjects/GroundwaterRechargeOpportunities

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