WHITCHURCH ENGINEERING

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March 5th, 2024

Bear River Band of Rohnerville Rancheria
564 Singley Road
Loleta, CA 95551

RE: Bear River Rancheria Stormwater Flooding Site Visit, Findings, and Recommendations
Site Investigation of Six Sites of Stormwater Flooding
564 Singley Road, Loleta, CA 95551
APN: 309-051-804

JN: BRB2401

To whom it may concern,

The purpose of this letter is to report the findings of Whitchurch Engineering, Inc. representatives found during a site visit to the Bear River Band Rancheria. The purpose of said sight visit was to inspect six separate site experiencing flooding, and evaluating each site to determine reports and analysis necessary to adequately address the differing causes of area flooding at each location and proposed a potential plan of action for repairs and improvements.

Site 1 – Existing Residence & Road – 567 Singley Road

The existing site is a single-family residence with a gravel access road which is the main area of flooding. The road features a small head wall which potentially has a culvert installed under the road, but inlet of the pipe was inaccessible due to heavy soils infill. The head wall was primarily experiencing stormwater inflow from a historic, uphill, stone lined swale that was in poor condition The majority of the swale has been covered in vegetation and the majority no longer includes rocky flowline protection. The surrounding grassy hillside contributes additional runoff due to observed low levels of infiltration, and does not infiltrate in place. Soils were inundated with standing water, and/or full saturation of the top 6” of soils in a 5’ radius around uphill of the observed headwall.

Report Recommendations

Whitchurch Engineering, Inc. recommends the following reports be prepared to properly inform the design process to adequately attenuate experienced flooding on site.

1. Soils Report and Textural Analysis

   A soils report including textural analysis and infiltration testing of soils onsite. The site includes a reasonable amount of permeable surface coverage, but water is concentrated at the theoretical outfall in large quantities. Soils information will be used to inform any concrete design necessary for a new culvert installation, a potential infiltration ditch design, or soils quality improvement recommendations to facilitate drainage.

2. Topographical Survey

   A topographical survey will be used in conjunction with a stormwater hydrology analysis to define the drainage management area contributing stormwater runoff to the existing culvert. The topographical survey should include a majority of the uphill area perceived to be contributing stormwater onto the project site.

3. Hydrological Analysis

   The hydrological analysis is necessary to size adequate storm drainage routing infrastructure. This report defines the volume and flowrate that will be used to size a new culvert, and any other drainage improvements proposed.

4. County Permitting

   This site requires County permitting as it is not yet within the Trust of the Rancheria. County permitting assistance could include grading, erosion and sediment control plans, stormwater control plans and calculations, and construction notes depending upon final engineered solution proposed. At the bare minimum, the county will require a site plan include the extents of the parcel and topographical information of the immediate project area.

Site Improvement Recommendations

Based on the observations of Whitchurch Engineering, Inc. staff made during the site visit, we recommend the following improvements be made on site. We assume the following improvements will be made for the purposes of construction cost estimation.

1. Exploratory Excavation

   The existing headwall be dug out during dry weather conditions in an attempt to observe the existing drainage structures. This will inform the existing drainage flow patterns on site to determine where the proposed engineering solution will ultimately direct stormwater flow. If a culvert is found installed within the headwall, both ends of the culvert should be located, and the culvert should be flushed for inspection.

2. Install a French drain/other collection or infiltration system uphill of the existing culvert

   Collecting uphill drainage and dispersing stormwater drainage across the permeable area will assisting in infiltration, and excess flow can be routed via subsurface piping to the existing/or newly installed culvert to be routed offsite.

3. Install a new headwall and culvert

   A new traffic rated culvert with an elevated inflow sized to manage the volume and flow rate of stormwater calculated within the hydrological analysis will ensure safe drainage. Based on our observations of existing soils infill of the current culvert arrangement, we recommend a raised inflow with a ponding feature to allow for silt and soils to settle out of inflowing water before being routed further downstream via the new culvert. This will reduce the impact of erosion and soils infill at the site outflow culvert.

4. Repair/Replace Existing Rocked Swale

   The existing rock swale is in disrepair, and is no longer adequately armored to protect against erosion, nor is it effectively routing storm water to the observed culvert. Resizing and grading the swale based on the hydrological analysis, and improving it with filter fabric and larger rock armoring that will remain in place will ensure positive drainage of the surrounding area towards the culvert.

Site 2 – Gaming Office Parking Lot

The gaming office is southeast of the existing casino and hotel building. The building was installed before an uphill parking lot to the northeast and is currently experiencing a significant amount of runoff from the asphalt impervious area running over the uphill lawn, resulting ponding against the foundation and siding of the building.

Report Recommendations

Whitchurch Engineering, Inc. recommends the following reports be prepared to properly inform the design process to adequately attenuate experienced flooding on site.

1. Soils Report, Textural Analysis, and Hillside Evaluation

   A site report including textural analysis with a focus on hillside stability to the southeast of the building and parking area will be used to inform an overflow outfall to route stormwater from the existing parking area to the east instead of towards the existing building. The stability of the downhill soils including will need to be protected to not contribute to hillside failure or continuous erosion.

2. Hydrological Analysis

   A hydrological analysis should include a rough estimate of impervious area contributing to stormwater routed towards the existing building. This analysis does not necessarily require topographical survey as the drainage contribution area is significantly smaller than Site 1. Hand measurements of the existing asphalt should provide adequate information to define the volume and flow rate of stormwater.

Site Improvement Recommendations

Based on the observations of Whitchurch Engineering, Inc. staff made during the site visit, we recommend the following improvements be made on site. We assume the following improvements will be made for the purposes of construction cost estimation.

1. Install 6” Curb & Gutter

   The existing parking lot does not feature a curb between the asphalt and grass area west of the building. A curb and concrete gutter will route stormwater east, and protect the building from direct stormwater runoff that does not infiltrate across the lawn.

2. French drain/Stone lined Swale

   The curb will route stormwater either into a French drain, or a stone lined swale to route water away the building, and the additional downhill existing concrete foundation. This feature should route drainage following the natural grade to the east if soils indicate that the hill side can maintain stability with the addition of stormwater to the hillside.

3. Rocky Energy Dissipater

   If the hillside receives concentrated stormwater run off from the proposed French drain or swale, an energy dissipater should be installed to protect the outfall to the hillside. This will protect from erosion and hillside damage. The energy dissipater should be installed at the outfall of culvert or at the end of the proposed swale.

Site 3 – Bowie Road Western Apartments

Four sets of town homes have been installed between Highway 101 and Bowie Road. Each town home features a parking area for four vehicles which route storm drainage into a 12" wide curb cut at the building sidewalk to flow between each building towards a designed drainage retention area 100' behind the buildings. The existing conditions seem to indicate that there were swales routing stormwater from in between the buildings to the retention basin in the rear. There are three existing swales however, two of the three are extremely over grown and might not have been armored or lined with filter fabric to maintain the integrity of the swales. The more northern swale is deeper, and armored with rocks. The surface grading between the curb cuts, all the way to the point of inflow at each swale is poorly grade, and does not promote positive drainage towards the retention area, but features adequate armoring.

Report Recommendations

Whitchurch Engineering, Inc. recommends the following reports be prepared to properly inform the design process to adequately attenuate experienced flooding on site.

1. Review of Existing Hydrological Analysis

   Trinity Valley Consulting Engineers completed a hydrological analysis delineating the drainage area of the housing project and sizing storm drainage features. This report should be reviewed and volume, flow rate, and design of all drainage features should be reviewed and confirmed to be accurate. Hand measurements of the existing asphalt, concrete, and buildings themselves should provide adequate information to confirm calculations where necessary.

2. Soils Report and Textural Analysis

   A soils report including textural analysis and infiltration testing of soils onsite. The site includes a reasonable amount of permeable surface coverage, but water is not infiltrating over the back lawn, and remains saturated in place. Soils analysis will provide pertinent information for a potential infiltration ditch design improvement, including a piped overflow to the existing main retention area to the northeast of the housing development.

3. Check flow line elevations

   A contractor/surveyor should be employed to measure the elevation from the curb cut inlets to the swale outflow into the retention basin. Full topographic survey should not be necessary, and the use of an AutoLevel can be used to confirm the slope from the curb drains to the retention basin. This will confirm whether or not positive drainage is currently achieved, and existing grades will be used to propose new grading to achieve positive drainage if the existing grades do not match the design by Trinity Valley Consulting Engineers.

Site Improvement Recommendations

Based on the observations of Whitchurch Engineering, Inc. staff made during the site visit, we recommend the following improvements be made on site. We assume the following improvements will be made for the purposes of construction cost estimation.

1. Clear existing rock and regrade

   Based on site observations, the existing rock armoring between the buildings is not graded to achieve positive drainage towards the retention area. The rocks should be cleared, the area regraded with a well-defined flow line at the center line of the open area. Currently rocky armoring is above the lip of the curb cut, rocks should be flush, if not just below the lip of the concrete. The area should then feature filter fabric, at the very least in the defined flow line, then armoring can be reapplied.

2. Clear Swales of Vegetation and Improve

   The swales should be cleared of all vegetation, and prepared for regrading. Using the flow line elevations found by the contractor/surveyor, the swales should be regraded to 1.5% to 2% positive drainage towards the retention basin. The grading needs consider that a layer of rock will be installed to ensure that the flow line won't elevate once the rock is installed.

3. Armor inflow to retention area

   The existing retention area is unlined with filter fabric, or armoring. The inflow to the retention area should be armored with an energy dissipater to avoid erosion into the basin. The energy dissipater should include filter fabric and should be monitored to ensure that rocks don't move off the flowline into the retention area.

4. Overflow to Existing Main Stormwater Retention

   The existing retention area in the rear of the buildings has no overflow to alleviate stormwater volume in the case of a storm greater than the design storm of the basin. There is an existing stormwater retention basin to the north east of the retention basin that is oversized and based on client feedback drains well. An overflow should not contribute volume to the larger pond unless excess stormwater is experienced, thus it won't pose an undue risk of causing an overflow of the larger retention area. Elevations should be confirmed by the contractor/surveyor at the time of elevation confirmation proposed earlier in this section.

Site 4 Northeast Bowie Road Apartment

The existing site is well drained in the frontage of the building, but is experiencing stormwater run on from the east of the parcel where there is an existing wetland. This wetland was bermed on its eastern side which forces its outflow to run on towards the buildings. A French drain has been installed to divert run on water towards the wetlands normal and natural outflow to the north. The french drain is out falling a steady flow of water, and the soils between the building and french drain remain saturated. Drainage between the buildings is directed towards the parking area to the west of the buildings. These areas were draining adequately, but building down spouts are contributing significant water without infiltration.

Report Recommendations

Whitchurch Engineering, Inc. recommends the following reports be prepared to properly inform the design process to adequately attenuate experienced flooding on site.

1. Hydrological Analysis

   The hydrological analysis is necessary to size adequate storm drainage routing infrastructure and define the volume of storm water that has inundated the area. An approximate drainage management area of the wetlands, buildings, and surrounding lawns can be used in lieu of topographical survey to define the uphill areas running on to site.

Site Improvement Recommendations

Based on the observations of Whitchurch Engineering, Inc. staff made during the site visit, we recommend the following improvements be made on site. We assume the following improvements will be made for the purposes of construction cost estimation.

1. Site monitoring

   The installed french drain is providing adequate drainage from the wetland run on currently. The site should be observed and flow rate out of the french drain should be monitored to confirm whether or not it is adequately addressing the run on from the wetlands. A variety of storms should be monitored included several days after to confirm drainage is adequate. After which additional improvement recommendations can be made.

2. Potential Upgrades

   After reviewing the site monitoring, improvement could include the following engineering controls to improve area drainage behind the existing apartment buildings.

   a. An additional french drain leg tying into the existing layout from between each building.
   b. Install physical separation (i.e. earthen berm) along the periphery of the western edge of the wetland. This would include an armored outlet to ensure pre-design flow out of the wetland directed away from the buildings.

Site 5 – Single Family Residence Garage Flooding

A single-family residence (352 Brenard Way) is experiencing stormwater flooding of their garage on the east side of the building. This is mostly due to the garage and the building itself being downhill of a paved driveway and the surrounding grass hillside. There is an existing drainage line along the west side of the building that is out falling to the vegetation just north of Brenard Road. The area of outfall was saturated and muddy. The building is also downhill and flat graded up to the foundation. This area is experiencing inundation and was very saturated. It was observed that the majority of soils around the building were saturated, even around the drainage line drainage area.

Report Recommendations

1. Hydrological Analysis

   The hydrological analysis is necessary to size adequate storm drainage routing infrastructure and define the volume of storm water that has inundated the area. The drainage area is quite small being mostly defined by the driveway. Typical hand measurements can be used to define the area and calculate the perceived stormwater volume.

Site Improvement Recommendations

Based on the observations of Whitchurch Engineering, Inc. staff made during the site visit, we recommend the following improvements be made on site.

1. Trench drain installation

   The garage is the ultimate downhill concentration point of the asphalt driveway. A trench drain servicing the full width of the garage building will head off and route stormwater away from the building. The trench drain should be routed out to the road to the south to an appropriate outlet location.

2. French drain installation

   The north of the building is fully saturated and based on site observations it does not infiltrate adequately or run off site. A french drain downhill of the northern slope that connects into the proposed trench to ultimately leave site would alleviate saturation of the flat area downhill of the slope.

Site 6 – Carroll Rd Alley Way Drainage Swale

There is a central alley way running between the east and west ends of Carroll Road. The homes within the area have garage access serviced by this alley way and stormwater from all buildings and the road run to the north to a drainage swale. Homes on the north side of the alley way feature 4”-6” culverts beneath their driveways. It would appear that the swales were built with 3”-6” rocks and approximately 4” of depth. Small willows have taken root in the swale via natural seeding and pollination, thus impacting the armoring and general drainage. All culverts are silted in and are not adequately routing drainage downhill. Uphill culverts look to be 6”-8”, while downhill culverts appear to be all 4” in diameter. Road way runoff is currently unable to enter the swale as it is overgrown with grass and has accumulated soils. Several cuts have been made to assist in drainage from the road. All the buildings built on the south side of the alley way include a drainage pipe that routes stormwater from the rear and side of the building to the alley way. These pipes are silted in, potentially broken, and are not sized adequately to drain the area due to each piped area being downhill from the next eastern house.

Report Recommendations

1. Soils Report

   A soils reports should include the infiltration rate of soils onsite. The site includes a reasonable amount of permeable surface coverage, but water is saturating at the toe of each slope throughout the housing development. Soils information will be used to inform potential for infiltration onsite to determine how much drainage should be removed and sent towards the drainage swale and downhill.

2. Topographical Survey

   A topographical survey will be used in conjunction with a stormwater hydrology analysis to define the drainage management area contributing stormwater runoff to the existing swale. The topographical survey should include a majority of the uphill area perceived to be contributing stormwater onto the project site.

3. Hydrological Analysis

   The hydrological analysis is necessary to size adequate storm drainage routing infrastructure, specifically the culverts underneath the northern driveways. This report defines the volume and flowrate that will be used to size each culvert.

Site Improvement Recommendations

1. Remove Vegetation and Rebuild

   All vegetation should be removed from the drainage swales and they should be reconstructed based on the calculations within the hydrologic analysis. Once the vegetation is cleared, filter fabric and rock armoring should be installed. All culverts need to be removed, and replaced. Sizing of the culverts will be determined within the hydrological analysis. Inflow and outflow of the pipes should feature filter fabric and rocking to assist in keeping the inlets clear of soils and maintain an adequate flow line. Road drainage should be routed into the drainage swale not just as sheet flow, but should have intermittent armored inflow routes to reduce soil erosions and infill of sediment into the swale.

2. French Drain and Collection Points for Northern Residences

   The existing pipes at the toe of each uphill slope contributing run off to each tiered residence below. It appears that there is no drainage installed and run off is expected to sheet flow as overland flow towards the road side swale. To improve drainage and reduce soils saturation, a french drain and drainage pipe should be installed at the toe of each slope. The subgrade pipes should direct excess runoff into the road side swale with an armored, energy dissipater to ensure that erosion does not occur. Topographical survey and the associated hydrological analysis will be used to size these features.

3. Remove and Rebuild Southern Pipe Drainage

   There are existing pipes at the toe of each uphill slope of each tiered residence on the south side of the alley contributing run off to the road and ultimately the northern ditch. These pipes appear to be undersized and are not adequately draining the downhill yards resulting in highly saturated soils. Once these pipes are removed, a french drain should be installed to intercept runoff and route drainage to the road and ultimately into the drainage swale. The hydrological analysis and topographical survey will be used to define the volume and flowrate of stormwater into each french drain and allow for sizing.

Based on visual observations made in the course of visiting of the six different sites of flood and stormwater inundation, and based on experience as an engineer, our recommendations are preliminary and are not intended as a complete scope of work. These recommendations should be evaluated by the awarded bid engineer and additional reports, analysis, or calculations may be found to be necessary by said engineer.

Please do not hesitate to contact this office with any questions or concerns regarding this preliminary site inspection and scoping letter.

Sincerely,

Jeffrey Laikam, PE
RCE# 68586

JTL/ntn