## APPENDIX A TABLE OF CONTENTS

Appendix A-1: Project Meeting Minutes.....A-3
Appendix A-2: Workshop Meeting Minutes..... A-41
Appendix A-3: Public Meeting Minutes..... A-61
Appendix A-4: Stakeholder Meeting Minutes..... A-77

# Appendix A
# Project Correspondence

**This Page Intentionally Left Blank**

Appendix A-1

# Project Meeting Minutes

**This Page Intentionally Left Blank**

# South Boulder Creek Progress Teleconference Meeting No. 1 Notes

ATTENDEES: Kurt Bauer/City of Boulder, Bob Harberg/City of Boulder, Shea Thomas/UDFCD, Mark Glidden/CH2M HILL, Alan Turner/CH2M HILL, Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: February 11, 2010

## Status of the Model

The 8-meter model did not accurately portray the median barrier at US Highway 36. The median barrier is important to the flooding characteristics so the bathymetry file is being updated to include the median barrier. The 8-meter and cutoff model will be re-run with the new bathymetry.

## Alan Taylor's Involvement

During the meeting, it was reiterated that Alan Taylor's involvement will be most beneficial to the project early in the process of the alternatives development to utilize his knowledge of the study area and problem areas. The project team will include Alan on all email correspondence and get him involved in the bi-weekly calls.

## Review and Discussion of Preliminary Screening Matrix

As a result of the initial project workshop, the matrix was modified in the following ways:

- The lined flood channels solution was combined with the existing channel improvements.
- Detention as a possible solution was divided into local and regional detention.
- Acquisition of flood prone properties was determined to be limited to high hazard zones.
- Flood proofing of critical facilities was separated from non-structural methods.

**Reach 1:**

- Development of a naturalistic channel was removed due to right-of-way constraints.
- Installation of underground conduits is mostly viable except at the Viele Ditch where there are T&E species.
- Limited structural improvements are generally viable except where the floodplain is broad.
- Existing channel improvements are generally feasible except at the business park where there are regulated wetlands and at the Viele Ditch where there are T&E species.
    - The city is required to mitigate wetlands at a 2:1 ratio making it very hard to mitigate more than 1 acre of wetlands. Any wetland categorized as highly functioning is


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




essentially untouchable. Kurt Bauer will send CH2M HILL the GIS layer of highly functioning wetlands.

- Regional detention considers detention upstream of US Highway 36.
- Local (Sub-Regional) detention considers detention downstream of US Highway 36 which is only possible in a few locations. Local detention may or may not be online and is designed to address specific flooding issues such as the C-2 loading points.
- Acquisition of flood prone properties will not be considered within this reach because no structures are within the high hazard zone.
- Non structural methods include not allowing owners to re-build in the floodplain, education, and a warning system. For non-critical facilities, it will be up to the owner to perform flood proofing. This solution will be included as part of the baseline alternative.
- Flow diversion is defined as redirecting the flow, probably towards the mainstem of South Boulder Creek. This solution was previously called relocation of channels. Flow diversion can be open channel or an underground conduit.

**Reach 2:**

The discussion of the matrix for Reach 2 was similar to the discussion of the matrix for Reach 1.

In an email, Chuck Howe suggested raising the berm at Foothills Parkway to reduce the flooding in the West Valley. CH2M HILL will respond to Chuck saying that this possible solution will be evaluated as part of the potential solutions matrix. Other possible solutions will only be added to the matrix if they do not fit specifically into a category on the existing matrix.

**Comments on the Matrix**

The project team must be sure to include all the potential solutions presented in the Taggart study as potential solutions in the matrix. An on-stream reservoir would be included in the regional detention solution. By not going into specifics in defining the potential solutions at this time, it allows the project team to look at a variety of different alternatives within each potential solution. CH2M HILL will use the MIKE FLOOD cutoff model to determine the maximum volume of water that must be stored to eliminate the overtopping of US Highway 36 and flooding in the West Valley from the mainstem of South Boulder Creek.

## Initial Public Meeting/ Open House

The preliminary plan is to hold the first public meeting on Wednesday, March 3rd 2010 from 5:30 – 7:30 PM in the East Boulder Recreation Center. The public meeting will begin with a short presentation (~1/2 hour) followed by an open house style setting with three or four stations.

## Presentation of Costing Information for Preliminary Screening of Alternatives

The screening process will be used to determine how potential alternative elements compare to each other. The project team will use general cost approaches such as assigning detention ponds a cost per acre-ft or assigning culverts a cost per square foot per linear foot. A cost benefit analysis will be performed for each included in the screening process.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

For Fourmile Canyon Creek, Love and Associates and Icon Engineering produced vastly different benefit-cost ratios. For South Boulder Creek, the FEMA BCA model will be used. CH2M HILL will look into the depth-damage curves from the FEMA BCA model and compare to the depth-damage curves used damage estimates from the risk assessment. If the depth-damage curves are substantially different, an adjustment factor may be used.

### Flood Threat from Lower Basin Storm

During the kick off meeting, there were questions as to whether the peak flow and maximum flooding extents seen in the West Valley come from a thunderstorm upstream over the mainstem of South Boulder Creek (South Boulder Creek floodplain study) or from a similar thunderstorm placed directly over the C-2 Basin (HDR XPSWMM Analysis). The results of the cutoff model will be compared with the HDR XPSWMM Analysis to determine the differences in the flooding extents in the West Valley between the two approaches. CH2M HILL will also compare the hydrographs at the C-2 loading points from the two approaches.

### Discount Rate

FEMA requires a discount rate of 7% for flood mitigation projects to receive FEMA grant money. UDFCD typically uses a discount rate of around 3.5%. It was agreed upon that a discount rate of 7% would be used for this project.

### Action Items

- Kurt Bauer will provide CH2M HILL with the highly functional wetlands GIS layer and a map of the siren coverage in the study area.
- The first public meeting will be scheduled for Wednesday, March 3rd from 5:30 – 7:30 PM in the East Boulder Recreation Center.
- Kurt Bauer will send CH2M HILL the correspondence between Icon Engineering and Love and Associates regarding the FEMA BCA model.
- CH2M HILL will look into the depth-damage curves from the FEMA BCA model and compare to the depth-damage curves used damage estimates from the risk assessment.
- CH2M HILL will compare the hydrographs at the C-2 loading points from the cutoff model with the hydrographs from the HDR XPSWMM Model.
- The project team will include a regional detention alternative that does not utilize the CU property in the alternatives analysis.
- Shea Thomas will send the project team the UDFCD Master Plan Cost Spreadsheet.
- CH2M HILL will continue working with Eric Fontenot at DHI to complete the cutoff model.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Teleconference #2 Meeting Notes

ATTENDEES:

| | |
|---|---|
| Bob Harberg / City of Boulder | Consulting |
| Kurt Bauer / City of Boulder | Mark Glidden / CH2M HILL |
| Shea Thomas / UDFCD | Alan Taylor / CH2M HILL |
| Alan Taylor / Alan Taylor | Aaron Cook / CH2M HILL |

FROM: CH2M HILL

DATE: February 23, 2010

## Review of Past Meetings Actions Items

- CH2M HILL received the functional wetlands and siren coverage GIS layers form the City of Boulder
- The first public meeting has been scheduled for March 3, 2010 in the Flagstaff Room of the East Senior Center from 5:00 PM – 8:00 PM
- Kurt Bauer sent CH2M HILL correspondence between Icon Engineering and Love and Associates regarding the FEMA BCA model.
- CH2M HILL will look into the depth-damage curves from the FEMA BCA model and compare to the depth-damage curves used damage estimates from the risk assessment.
- CH2M HILL has reviewed the hydrology for the C2 basin loading between the SBC Study and the lower basin thunderstorm.
- The project team is looking into regional detention sites that do not utilize the CU property.
- Shea Thomas sent the project team the UDFCD Master Plan Cost Spreadsheet.
- The MikeFlood cutoff model is complete.

## Review of Lower Basin Hydrology vs. SBC Hydrology for C2 Basin Loading

CH2M HILL presented a spreadsheet to the team showing the C2 sub-basin loadings from the MikeFlood Floodplain Study, the MikeFlood Lower Storm Center Analysis, and the HDR XPSWMM Analysis. For the MikeFlood Analysis, the sub-basin loading was extracted from the MikeFlood regulatory model. Only the peak flows in the C2 basin were available for the Lower Storm Center Analysis and the XPSWMM Model. The peak flow from the C2 basin was apportioned using the same ratio as in the MikeFlood Regulatory Model to determine the peak flow at each C2 sub-basin.

The project team is still looking for the 5-year peak flow rates from the City of Boulder Stormwater Master Plan for comparison.

After looking at the spreadsheet, the team decided infrastructure in the West Valley will be sized according to the peak flows from the MikeFlood Lower Storm Center Analysis. All


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




damage estimates from the floodplain study are based on the results of the regulatory model so there may not be a direct comparison between the damage estimates from the floodplain study and the damage estimates for the flood mitigation study. The 500-year damage estimates from the floodplain study may approximate the 100-year peak flows in the lower storm center analysis.

## Review of Cutoff Model Results

The cutoff model was presented to the project team as depth of flow versus time step. The sinks in the model were set up downstream of US Highway 36 to collect any overtopping flows. The cutoff model was set up to contain flows overtopping US Highway 36 and flows from the Viele Ditch and New Anderson Ditch. This model is mean to replicate storage upstream of US Highway 36 which would also store flows in the Viele Ditch and New Anderson Ditch.

The cutoff model shows that there are some localized flooding issues in the West Valley but storage upstream would control most of the damages in the West Valley. CH2M HILL will determine the volume of water that is being cutoff which will represent the volume of detention required upstream of US Highway 36 to prevent overtopping. This will be done by cutting transects in the MikeFlood model. It should be noted that the cutoff model includes the median barrier and additional storage will be required if the east bound lane of US Highway 36 cannot overtop.

For the public meeting, one or two screenshots from the cutoff model will be presented to show the maximum extents of flooding in the West Valley with no flow overtopping US Highway 36.

## Updated Alternatives Matrix

CH2M HILL refined the previous matrix with additional details. The routine maintenance alternative was removed from the matrix as it will be included in all alternatives. The naturalistic channels alternative was also removed because it is not possible to place a naturalistic channel in the West Valley due to right-of-way constraints. CH2M HILL will send the updated matrix to the project team for review.

The project team looked specifically at the West Valley between US Highway 36 and Baseline Road. In this area, the Stormwater Master Plan recommends increasing the capacity of storm sewers and the City of Boulder would like the project team to include these recommendations. CH2M HILL will look into the Stormwater Master Plan to determine if a BCA was performed or if damage estimates are presented.

## Public Meetings

For the public meeting, four GIS figures will be presented; Above US Highway 36, from US Highway 36 to Baseline Road, from Baseline Road to Arapahoe Avenue, and North of Arapahoe Avenue. During the public meeting, Alan Taylor, Mark Glidden, Alan Turner, and a representative from the City of Boulder will each be stationed at one board to answer questions from the public.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

## Next Steps

### Action Items

- CH2M HILL will review the correspondence between Icon Engineering and Love and Associates regarding the FEMA BCA model.
- CH2M HILL will look into the depth-damage curves from the FEMA BCA model and compare to the depth-damage curves used damage estimates from the risk assessment.
- The project team is looking for the 5-year peak flow rates from the City of Boulder Stormwater Master Plan for comparison.
- All infrastructure in the West Valley will be sized according to the results of the MikeFlood Lower Storm Center Analysis ($Q_{peak}$ = 1100 cfs).
- CH2M HILL will determine the volume of water that is being cutoff which will represent the volume of detention required upstream of US Highway 36 to prevent overtopping. This will be done by cutting transects in the MikeFlood model.
- CH2M HILL will send the updated matrix to the project team for review.
- CH2M HILL will look into the City of Boulder Stormwater Master Plan to determine if a BCA was performed or if damage estimates are presented.
- CH2M HILL will send the four GIS figures to the project team for review.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Progress Meeting March 26, 2010

ATTENDEES: City of Boulder

FROM: CH2M HILL

DATE: April 7, 2010

## Presentation of Alternatives

This meeting was conducted with Kurt Bauer from the City of Boulder and Alan Turner, Mark Glidden and Aaron Cook from CH2M HILL to discuss proposed South Boulder Creek Mitigation Plans, design hydrology and progress forward with the project. Four alternative drainage corridors were presented which were assembled from the element-screening matrix and generally followed the recommendations from the City of Boulders *Stormwater Master* Plan. The four corridors are described below.

1. Dry Creek No. 2 Ditch Alternative – This alternative uses Dry Creek No. 2 Ditch as the primary conveyance corridor for the drainage of flood waters from the West Valley (See Attached Figure **Upstream Storage Dry Creek No 2 Ditch Alternative**)
2. New Conveyance Alternative – This alternative adds additional major conveyance through the West Valley South of Baseline Road to Boulder Creek (See Attached Figure **Upstream Storage New Conveyance Alternative**)
3. Bear Canyon Creek Alternative – This alternative allows diversions of Wellman Ditch overflow as and overflows along Foothills Parkway to be diverted to Bear Canyon Creek (See Attached Figure **Upstream Storage Bear Canyon Creek Alternative**)
4. High Hazard Alternative – This alternative removes the two structures identified in the high hazard zone and utilizes pipes to remove these structures from the High Hazard Zone (See Attached Figure **High Hazard Alternative**)

These four general alternatives will be assessed for two separate conditions:

1. Detention Upstream of US-36
2. No Detention Upstream of US-36

and for the most conservative flow conditions between the following:

1. 10-year to the 500-year regulatory flows
2. 5-year to 100-year *Lower Storm Center Flow Analysis*

In addition to the above Kurt emphasized the need to locate a detention alternative outside of the CU property. Review of the topography and floodplain boundaries indicated that there could be a potential site for off line detention downstream of SH-93 and up stream of the CU Property on the left bank of South Boulder Creek. This detention site will utilize overflows and existing culverts under SH-93 to funnel overflows to the detention site until





the flows could be released back to South Boulder Creek. The project team is continuing to determine the feasibility of this option.

In addition to additional detention sites, a review of options along the mainstem were requested to be reviewed. To begin this process CH2M HILL will create a levee MIKE FLOOD model to determine the downstream effects of channelizing flow through US-36 downstream along the mainstem of South Boulder Creek. To accomplish this it will be assumed that the Existing CU Levee will be extended to US-36 to prevent overflows to the west. Currently this model is being reviewed by DHI for correctness.

## Review of Future Progress

In order to understand how current work will be used in conjunction with future MIKE FLOOD runs a review of preferred alternatives to be reviewed was completed. The Best Alternatives to be modeled in MIKE FLOOD and included in detailed cost benefit analysis will include:

1. High Hazard Alternative that includes conveyance to remove homes from the High Hazard Zone
2. High Hazard Alternative that includes acquisition of the High Hazard Zone properties
3. Detention at the CU property with conveyance improvements through the West Valley
4. Detention at the outside the CU property with conveyance improvements through the West Valley
5. Conveyance through the West Valley assuming no detention and designed for the full South Boulder Creek overflows.
6. An alternative that includes conveyance through the West Valley for 10 – year to 100-year flow rates obtained fort the City of Boulder *Stormwater Masterplan.*
7. An alternative that includes improvements to the mainstem of South Boulder Creek to eliminate or minimize flooding through the West Valley.

The conveyance improvements will include the best plan chosen after an analysis of the alternatives from above.

## Design Hydrology

A review of the memorandum of understanding regarding design flow rates. The discussion has lead to a review of the flowrates and an update of the memorandum of understanding. The memorandum will be revised and presented during the next progress meeting.

# SBC Flood Mitigation Study - Progress Meeting #5 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: CH2M HILL

DATE: April 14, 2010

## Presentation of Preliminary Alternatives and Drainage Corridors

**High Hazard Alternative**: Two options were considered for the high hazard alternative; (1) removing structures from the high hazard zone with improved conveyance and (2) purchasing structures in the high hazard zone. In the West Valley there are only two structures in the high hazard zone, both near the overflow of US-36 into the West Valley.

The goals of the high hazard alternative will not include removing all high hazard zones from the study area. The City of Boulder plans to use a flood warning system in place of removing all high hazard zones.

**Critical Facilities**: critical facilities are to include any facilities that have hazardous material on site, such as the chemical facility or gas stations, in addition the critical facilities already included in the alternative plans (schools, daycares, assisted living centers, etc.). Kurt Bauer will provide CH2M HILL with the City of Boulder GIS layer of critical facilities.

**Alternative Alignments:** Three possible alternative alignments for conveyance improvements within the West Valley have been established.

1) Dry Creek Ditch #2 Alignment – drive all flows to Dry Creek Ditch #2. Includes improvements at Arapahoe Avenue.

2) Bear Canyon Creek Alignment – divert flows along Foothills Parkway to Bear Canyon Creek. Removes some pressure from Dry Creek Ditch #2. Improvements at Arapahoe Avenue are still needed. May be some issues with trans-basin diversion.

3) New Conveyance Alignment – divert flow through a new conveyance between Foothills Parkway and 55th Street. Removes some pressure from Dry Creek Ditch #2. Improvements at Arapahoe Avenue are still needed. Possible impacts to private property.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Review of Field Visit with Kurt Bauer and Alan Taylor on April 8, 2010

Kurt Bauer is interested in storage within the West Valley. Possible locations for storage include Manhattan Middle School and other parks. Kurt also expressed interest in preventing overflows of South Boulder Road, Baseline Road, and Arapahoe Avenue by creating a 3′ to 4′ structural barrier that would allow water to pond upstream of the road. The structural barrier could be used to separate bike trails from vehicle traffic. At Arapahoe Avenue, an underpass could be constructed for bike traffic and flood conveyance.

Constraints determined during the field visit:

- Due to right of way constraints, the pipe north of Manhattan Middle School from Tenino Avenue to Baseline Road cannot be modified.
- Dry Creek Ditch #2 between Baseline Road and the Wellman Canal cannot be modified due to the number of trees around the ditch.

## Report of Design Hydrology and Hydrology Memorandum

The hydrology Technical Memorandum has been finalized and includes peak flows at C2 loading points. The peak flows that will be used to size infrastructure are a combination of flows loaded directly at the C2 loading point plus the flows loaded at loading points upstream. This approach is similar to a typical master planning approach where a one-dimensional model is used.

## Report on Alternate Detention Sites

Two alternatives were evaluated for detention upstream of US-36 without impacting the CU South Property.

Option 1

- Between CU property and US 93
- Excavate South Boulder Creek overbank to allow overflows to reach detention pond
- Dry Creek Ditch #2 would also contribute to storage in detention pond
- Approximately 320 acre-ft
- Downstream depth is approximately 15 feet, embankment depth is approximately 18 feet
- Positives to option 1; no water rights issues
- Negatives to option 1; impacts to open space and private property

Option 2

- Between CU property and US 93, similar to option 1
- Excavate South Boulder Creek overbank to allow overflows to reach detention pond
- Dry Creek Ditch #2 would also contribute to storage in detention pond
- Approximately 320 acre-ft
- Downstream depth is approximately 8 feet, embankment depth is approximately 11 feet
- More extensive berm on the west side
- Positives to option 1; lower embankment height, no impacts to private property


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

- Negatives to option 1; impacts to open space, would need low flow channel for decreed flows in Dry Creek Ditch #2.

Both options are off-channel detention alternatives and do not require a Probable Maximum Flood (PMF) spillway. It was suggested during the meeting that the west berm be along Marshall Road and that the north berm could be aligned with an existing trail to minimize the disturbance to open space.

## Schedule

The Best Alternative Workshop was tentatively scheduled for April 26th, but has been moved to the afternoon of May 11th at the 13th Street Conference Room in Boulder. Over the next two weeks, CH2M HILL will size facilities to create the best alternative plans based on the three alignments presented above. CH2M HILL will then evaluate each plan using a benefit-cost analysis. The seven best alternative plans are tentatively as follows:

1. High Hazard Alternative that includes conveyance to remove homes from the High Hazard Zone
2. High Hazard Alternative that includes acquisition of properties within the High Hazard Zone
3. Detention at the CU property with conveyance improvements through the West Valley
4. Detention outside of the CU property with conveyance improvements through the West Valley
5. Conveyance through the West Valley assuming no detention and designed for full South Boulder Creek overflows
6. An alternative that includes conveyance through the West Valley for 10- year to 100-year flow rates obtained from the City of Boulder *Stormwater Master Plan*
7. An alternative that includes improvements to the mainstem of South Boulder Creek to eliminate or minimize flooding through the West Valley.

The project team is still evaluating alternatives and each alternative can include a number of different options. For example, alternative 4 may include multiple storage options, multiple storage volumes, and different alignments for improvements through the West Valley.

This best alternative plan information will be presented at the next bi-weekly teleconference. This will allow the project team to have a discussion and provide input on the best alternative plans. The information will then be presented to stakeholders at the workshop on May 11th.

## Damage Estimates

The BCA uses a discharge/damage relationship. The South Boulder Creek Risk Analysis used a depth/damage relationship at each structure. CH2M HILL is still working on the damage estimates.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #6 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: CH2M HILL

DATE: April 28, 2010

## Action Items from the Progress Meeting

- CH2M Hill will send out a packet of information to the project team and stakeholders prior to Workshop #3. This packet will include an agenda for the meeting, alternatives figures, and a summary of work to date.
- CH2M Hill will modify the figure showing detention south of the CU property to include City of Boulder open space and an outlet to the pond.
- The City of Boulder will meet with Don D'Amico, Open Space, to discuss the detention pond south of the CU property on City of Boulder open space.
- CH2M Hill will run a MIKE FLOOD Model to see if the detention pond south of the CU property prevents overtopping of US 36.
- CH2M Hill will size an outlet to the detention pond at Arapahoe Avenue if the culvert outlet does not include a bike path crossing.
- The City of Boulder will engage a representative from Manhattan Middle School to discuss the possibility of a local detention pond at the school.

## Water Resources Advisory Board (WRAB) Meeting

CH2M Hill is scoped to attend an initial and final WRAB meeting and will assist Kurt Bauer in creating figures and providing the advisory board with the necessary information.

## Review Outline for Workshop #3

After reviewing the draft outline, it was suggested that some of the information be sent to the stakeholders and project team prior to the workshop. Items to be sent out prior to the workshop include figures and a summary of work to date. Some attendees at the workshop such as representatives from WRAB, City of Boulder Open Space, and CU may not be interested in the technical aspects of how the project team arrived at the best plans. The project team will determine the best way to package the information so it isn't too technical and the package will be sent around May 5th to give the stakeholders a few days to review.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Review highlights of preferred plans

### Storage south of CU property:

In the current configuration, the detention pond south of the CU property is approximately 300 acre-ft, has a 12' berm, and is mostly on City of Boulder Open Space. Some excavation would be required. CH2M Hill will run a MIKE FLOOD model to determine if this detention pond would prevent the US 36 overtopping during the 100-year flood. Kurt Bauer suggested that an outlet to the pond and open space be added to the figure showing the detention pond. Representatives from the City of Boulder will discuss this alternative with Don D'Amico, City of Boulder Open Space.

### Storage at Arapahoe Avenue:

The City of Boulder Parks department is ok with the concept of storage at Arapahoe Avenue on the golf course. CH2M Hill will determine the size required for the outlet culvert if it is not used as a bike path crossing. Kurt Bauer will coordinate with the Parks department regarding the underpass outlet to the pond. The channel north of Arapahoe is private property and would require a drainage easement.

### Local Storage in the West Valley:

The maximum storage available at Manhattan Middle School is approximately 60 acre-ft. The City of Boulder will involve a representative from the school to discuss this alternative. CH2M Hill will create a figure showing detention at Manhattan Middle School similar to the figure showing the detention pond south of the CU property. At the middle school, there is the possibility to have different levels of inundation where different fields are inundated at different flood levels.

The maximum storage available at the Foothills Parkway and Baseline Road intersection is approximately 9 acre-ft. The maximum storage available at Baseline Road is approximately 37 acre-ft but a berm would have to be constructed on open space to make this alternative work.

In an alternative that include storage upstream of US 36 to prevent overtopping and local storage in the West Valley, most of the infrastructure along Dry Creek and in the West Valley does not need to be improved.

## Status of Cost Benefit Analysis

CH2M Hill has replicated HRD's damage estimate and reviewed UDFCD's criteria for cost benefit analysis. CH2M Hill will present the results of the cost benefit analysis at the workshop.

## Hydrology

Hydrology will be discussed with Kurt Bauer in greater detail outside of this progress meeting. Below is a summary of flows that will be evaluated for improvements in the West Valley:


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

- Regulatory Model Flows – determined from the MIKE FLOOD model in which overtopping of US 36 occurs. Large pipes through the West Valley are required to convey the 100-year Regulatory Model Flows.
- Lower Storm Center Flows – the 100-year peak flows from the Lower Storm Center analysis are greater than the 10-, 25-, and 50-year peak flows from the Regulatory Model.
- Stormwater Master Plan Flows – the 5-year peak flows from the Stormwater Master Plan are larger than the 10-year peak flows from the Regulatory Model because the Stormwater Master Plan thunderstorm was centered over the West Valley where as the thunderstorm for the Regulatory Model was centered upstream over the South Boulder Creek mainstem. The 5-year peak flows from the Stormwater Master Plan represent the lowest values that will be evaluated.

## Levee Model

CH2M Hill successfully ran a levee model in MIKE Flood. The levee to prevent overtopping of US 36 causes an increase in depth of approximately 0.1 meters for most of the South Boulder Creek mainstem north of US 36, although larger increases in depth are seen at some locations such as downstream of Arapahoe Avenue. The outlet to Leggett Reservoir overflows in the levee model. It was pointed out during the meeting that an increase in high hazard zones is likely for this alternative.

## Next Steps

CH2M Hill and Kurt Bauer will meet on April 30 to discuss the hydrology, alternatives, cost benefit analysis, and workshop #3 agenda in more detail. Workshop #3 is schedule for May 11. The project team may decide to cancel the progress meeting schedule for May 12.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #7 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: CH2M HILL

DATE: May 26, 2010

## Action Items from the Progress Meeting

- CH2M Hill will develop a conceptual sketch showing a revised detention pond at Marshall Road. This pond will not require excavating more than 5 feet and will not require a berm greater than 10 feet.
- Alan Turner will send an updated schedule to the project team.

## Review of Detention Alternatives Upstream of US-36

The City of Boulder asked CH2M Hill to evaluate two alternatives for regional detention upstream of US-36. Specifically, CH2M Hill was asked to evaluate storage at the gravel pits south of the CU property and at a property adjacent to Marshall Road. Neither of these parcels is located on the City of Boulder open space land.

### Storage at Gravel Pits

To prevent overtopping of US-36 with storage upstream of US-36, approximately 500 acre-feet of storage is required. The gravel pit parcel is approximately 25 acres in area and is located south of the CU property. Because the total area of the parcel is relatively small, the depth of storage required is approximately 30 feet. This pond would be filled from Dry Creek Ditch No. 2 and outlet via a gravity pipe to South Boulder Creek. Due to high groundwater in the area, the pond would most likely be constructed by excavating between 5 and 10 feet and constructing a berm between 20 and 25 feet.

### Storage at Marshall Road

The parcel at Marshall Road is approximately 23 acres and requires a storage depth of between 30 and 35 feet to store the 500 acre-feet required to prevent overtopping of US-36. This pond would be filled from Dry Creek Ditch No. 2 and overflows from South Boulder Creek. The pond could outlet to Dry Creek Ditch No. 2 or South Boulder Creek. Similar to the pond alternative at the gravel pits, this pond would most likely be constructed by excavating between 5 and 10 feet and constructing a berm between 25 and 30 feet to prevent groundwater issues and allow it to drain via gravity flow.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




The City of Boulder requested that CH2M Hill evaluate a variation of the storage at Marshall Road that extends partially onto City of Boulder open space. The project team agreed that it would not be possible to construct a 500 acre-foot detention pond with either excavating or constructing a berm on City of Boulder open space, although representatives from open space have stated that excavation or construction of a berm on open space would not be permitted. The City of Boulder suggested that the maximum excavation for this variation be 5 feet and the maximum berm height be 10 feet. This pond would be approximately double the area of the parcel adjacent to Marshall Road. CH2M Hill will develop a conceptual sketch showing the revised location of the storage pond at Marshall Road. Expanding the Marshall Road detention pond may also protect the trailer park located just east of Marshall Road.

The project team agreed that the Marshall Road and gravel pit detention alternatives are not feasible in the current configurations. These alternatives will no longer be considered in the alternatives analysis.

## CU Detention

Kurt Bauer, Mark Glidden, and Alan Turner met with Jeff Lipton from CU to discuss the CU detention option. Jeff stated that CU is willing to be flexible with the design of their property but any plan must maintain the developable footprint and the access road to the property is a constraint. CH2M Hill has identified a new alternative for CU storage which moves the storage to the east side of the property and builds up the rest of the land on the property to remove it from the floodplain. The existing levee would be removed and an embankment would be built up along the west side of the detention pond to match the elevation of the access road.

In the MIKE FLOOD Model, the Table Mesa Pond stores flow from the Table Mesa loading points as well as overflows from the Viele Channel. This pond is still inundated in the new CU detention alternative. The Table Mesa Pond can't be drained via gravity flow to the New Anderson Ditch because the pond is at a lower elevation than the ditch resulting in dead storage in the pond. It may be possible to drain the pond to Viele Channel near South Boulder Creek via gravity flow.

## FEMA BCA Benefit Cost Analysis Update

Alan Turner and Kurt Bauer met with representatives from FEMA and determined that we can use the FEMA BCA software without flow rates. The HAZUS model will be used and the approach will be similar to the approach taken by HDR.

## Modeling 7 Best Alternatives

CH2M Hill is in the process of modeling the 7 best alternatives in MIKE FLOOD. CH2M Hill is running the detention alternatives and only experiencing a few minor issues. Eric Fontenot/DHI is helping to solve some of these minor issues. By looking at the intermediate results files, it is apparent within a day or so whether a detention pond model will work or not, saving some time from the 3 days it takes to run the full regulatory model.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

## Next Steps

- Alan Turner will send an updated schedule to the project team.
- Kurt Bauer will set up a meeting with FEMA either the first or second week of June.
- The City of Boulder will meet with the representatives from open space to discuss the new pond configurations.
- The City of Boulder will schedule a meeting with Jeff Lipton/CU to discuss outstanding issues.
- The City of Boulder is scheduled to present the South Boulder Creek Master Plan progress to the Water Resources Advisory Board (WRAB) on June 21, 2010. The materials to be presented are due to the WRAB on June 11, 2010 and to Bob Harberg and Annie Noble for review prior to June 11, 2010.
- CH2M Hill will continue to run MIKE FLOOD models including the south of CU detention model.
- Kurt Bauer will attempt to contact a representative from Manhattan Middle School to discuss detention at the school.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #8 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: CH2M HILL

DATE: June 9, 2010

## Review of Storage Options above CU

The newest option for storage for storage south of CU uses as much private property as possible with as limited impact to open space as possible. The maximum berm height is 10 feet and the maximum excavation in the pond is 5 feet. The 10 foot berm height does not include the 3 feet required for the spillway. This detention pond alternative provides approximately 420 acre-ft of storage and covers approximately 38 acres, 11.5 of which are located on City of Boulder open space. The pond outlets to Dry Creek through a 6′ x 4′ concrete box culvert and to South Boulder Creek through 5 – 7′ x 5′ concrete box culverts. This pond is a peak shaving pond which is why the outlet to South Boulder Creek is so large. The pond fills from Highway 93 overflows and the pond is placed at a location that is already in the floodplain. This detention pond has limited impact to wetlands, does not impact Boulder County Critical habitat, but does impact three private parcels which would have to be purchased to construct the pond.

Kurt Bauer will meet with Don D'Amico to discuss this concept for storage south of CU. In this meeting, Kurt will reiterate that we can include additional wetland areas within the pond and that the City of Boulder will gain approximately 25 acres of open space if this pond is constructed.

## Modeling 7 Best Alternatives

The MIKE FLOOD modeling is working as expected with a few minor modifications to the plans presented at the last workshop. CH2M Hill has successfully modeled the detention pond at Arapahoe Avenue alternative, the CU storage alternative, the high hazard alternative, the and is working on the other alternatives. The number of MIKE FLOOD models that can be modeled concurrently limits the modeling effort. CH2M Hill will meet with Kurt Bauer and Alan Taylor next week to discuss the results of the modeling effort.

## FEMA BCA Benefit Cost Analysis Update

Kurt Bauer and Alan Turner met with FEMA and the Colorado Department of Emergency Management (CDEM) to discuss the benefit cost analysis used by HDR for the floodplain


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



mapping study. Both FEMA and CDEM agreed that the project team can proceed with the same procedure as was used by HDR. Alan Turner will document the benefit cost analysis procedure in a technical memorandum and send to the project team.

## PDM Grant

The CDEM is interested in the City of Boulder submitting for a PDM grant this year, specifically for the detention pond at Flatirons Golf Course/ Arapahoe Avenue. CDEM has agreed to split the cost to check the first floor elevations throughout the West Valley. The first floor elevations were originally surveyed via a window survey by HDR. CDEM did not specify how many structures need to be surveyed to confirm that the window survey is accurate.

## Schedule

The recommended plan workshop will be moved back by approximately one month to around July 28, 2010. This will allow CH2M Hill to complete the modeling and BCA analysis prior to the workshop. The City of Boulder agrees that this is a good idea.

CH2M Hill will not be attending the WRAB meeting. This WRAB meeting is an internal update for WRAB members and CH2M Hill will attend the first of two WRAB meetings in late August or early September.

## Next Steps

- CH2M Hill will coordinate a meeting with Jeff Lipton (CU) to discuss the CU detention alternative.
- Kurt Bauer will meet with Don D'Amico (City of Boulder Open Space) to discuss the south of CU detention alternative.
- Kurt Bauer will meet with representatives from Boulder Valley School District to discuss the detention pond at Manhattan Middle School.
- Kurt Bauer, Alan Taylor, and CH2M Hill will meet next week to discuss the results of the modeling effort.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #9 Notes

ATTENDEES: Kurt Bauer/City of Boulder, Bob Harberg/City of Boulder, Shea Thomas/UDFCD, Alan Taylor/Alan Taylor Consulting, Mark Glidden/CH2M HILL, Alan Turner/CH2M HILL, Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: June 23, 2010

## Land Acquisition Costs

The project team agreed that the land acquisition costs are as follows:

- Detention Ponds - $36,000/ acre
- Drainage Easements for Pipelines – 0.5 * Land Cost/SF
- Drainage Easements for Open Channels – 0.9 * Land Cost/SF

The land acquisition costs for detention ponds may be modified when more information is gathered from stakeholders such as CU and Boulder Valley School District.

The following table shows approximate land values in Boulder. This information was provided by the City of Boulder.

TABLE 1
Approximate Land Value Costs for Boulder

| Zone Code | Description | $/SF |
|---|---|---|
| AG | Agricultural | 0.8 |
| PU | Public | 19 |
| RB | Regional Business | 180 |
| CB | Community Business | 39 |
| HD | High Density Residential and Mobile Home | 50 |
| MD | Medium and Mixed Density Residential | 36 |
| LD | Low Density and Rural Residential | 22 |
| IND | Industrial | 15 |


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Review of BCA

CH2M Hill has reviewed both the United States Army Corps of Engineers (USACE) and HAZUS curves. The curves are similar and CH2M Hill will proceed with using the HAZUS curves for damage estimates to be consistent with the work performed by HDR.

The assessed structure values are currently approximately 15% higher than the assessed structure value presented by HDR in 2007. CH2M Hill will use the same procedure as HDR with the new assessed structure values.

## Modeling Progress

CH2M Hill is currently approximately 85% complete with the MIKE FLOOD Modeling and running 3 models concurrently. CH2M Hill will create a PDF of the resulting floodplain for the CU detention pond with local detention in the West Valley alternative to share with the project team. Some of the alternatives have included minor modifications from the plans presented in the last workshop but nothing significant.

## WRAB Meeting

Kurt Bauer presented to WRAB last week and did not receive a lot of direction from the WRAB representatives. Representatives from WRAB wanted a list of the critical facilities proposed for flood proofing in the high hazard/critical facilities alternative and this list was provided by CH2M Hill. Only three members of WRAB were present at the meeting.

## Flow Rates

In the West Valley, the only known local basin peak flows are the 5-year peak flow from the stormwater master plan and the 100-year peak flow at the confluence of Dry Creek Ditch No. 2 with South Boulder Creek. In order to recommend improvements for local basin peak flows, the project team needs to have a better idea of the peak flows caused by the local basin storm. In addition, the FEMA BCA only applies to the regulatory peak flow rates and damages for the local basin peak flows are unknown. The project team agrees that the scope of this project is to address the regulatory peak flows but that the project team as well as the City of Boulder must acknowledge the peak flows from the local basin storm.

The project team may agree to evaluate the local basin peak flows using either the standard UDFCD procedure or by moving the South Boulder Creek storm over the C2 B basin.

The project team will develop a phasing plan for the final recommended plan and CH2M Hill will evaluate the cost to benefit ratio for single elements such as the CU detention pond and the detention pond at Arapahoe Avenue for phasing purposes.

## Next Steps

Kurt Bauer, Mark Glidden, and Alan Turner will meet with Jeff Lipton (CU) to discuss the CU detention alternative on June 24th at 9:00 AM.

Kurt Bauer left two messages for Don D'Amico (City of Boulder Open Space) to discuss the south of CU detention alternative. Kurt will try to contact Don again.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

Kurt Bauer met with representative from Boulder Valley School District to discuss the Manhattan Middle School detention pond. Boulder Valley School District gave the go ahead to continue with this part of the plan.

Alan Turner and Alan Taylor will meet to discuss the best way to contact the ditch companies regarding additional storage at Baseline Reservoir.

The next workshop is scheduled for July 28th, 2010. CH2M Hill will discuss whether or not all the information needed for the next workshop will be ready by this date.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #10 Notes

ATTENDEES: Kurt Bauer/City of Boulder, Annie Noble/City of Boulder, Shea Thomas/UDFCD, Alan Turner/CH2M HILL, Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: July 7, 2010

## Review of Meetings

### Meeting with CU

Kurt Bauer, Mark Glidden, and Alan Turner met with Jeff Lipton from CU. Jeff is generally ok with the CU detention pond alternative but would like the project team to look into a few items. Jeff would like the project team to look into a pond which includes a berm along the northern edge of the Table Mesa Pond. Jeff also wants to know the total area of the pond on CU property, the total area of the Table Mesa Pond, and a proposed layout for the recreational fields' configuration within the pond area.

Jeff thought that the $36,000 per acre for land acquisition costs was too low for the CU South Campus property. It was agreed upon that the project team would assume the cost for land acquisition would match the undeveloped agricultural cost provided by the City of Boulder for all areas that are not proposed building sites. For proposed building sites, the project team should assume $19 per square foot for land acquisition costs.

### Meeting with Open Space

Kurt Bauer met with Don D'Amico from City of Boulder Open Space Department to discuss the latest version of the detention pond south of CU. Don made the following recommendations:

1. Minimize the impact of the berm on Open Space Property.
2. Look into using the properties adjacent to the detention pond between Marshall Road and South Foothills Parkway.
3. Look into using weirs/spillways as the outlet to the pond instead of culverts outlets.

## Update on Detention Alternatives for Open Space

CH2M HILL created a revised pond that minimizes the impact to open space and utilizes the adjacent properties between Marshall Road and South Foothills Parkway. The revised pond layout also includes a weir/spillway outfall to South Boulder Creek but the culvert outfalls at Dry Creek Ditch No. 2 and the other irrigation ditch through the pond must


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




remain as culverts to convey the decreed flows in the ditches. Grading is necessary at the culvert outfalls.

The main section of the pond has approximately at 350 acre-foot capacity and the pond section between Marshall Road and South Foothills Parkway has approximately a 70 acre-ft capacity. The main pond has a berm height of 12 feet which becomes 15 feet with the spillway. The berm height includes a combination of cut and fill. The small pond invert is 3 feet higher than the main pond so that the small pond drains to the main pond. Approximately 15 feet of excavation is needed in the southern most section of the small pond.

This revised alternative for detention south of CU has not been input into the MIKE FLOOD model but it is expected that limited improvements to the CU property are necessary with this alternative. A small berm along the Viele Channel is still required to prevent flows from reaching the Table Mesa pond. When water reaches the Table Mesa Pond, overtopping of US 36 occurs almost immediately.

## Review of Progress on Recommended Plan Workshop

CH2M Hill is running four MIKE FLOOD models concurrently. The results from the MIKE FLOOD models are being evaluated to determine the benefit-cost analysis for each alternative. It is expected that the MIKE FLOOD models and the benefit cost analysis will be complete within the next couple of weeks.

The Levee/ Mainstem Flow Containment alternative is currently being run in MIKE FLOOD. Two alternatives are being evaluated for the Levee/ Mainstem Flow Containment alternative designed to prevent overtopping of US 36 by forcing more flow to the South Boulder Creek mainstem and eventually into Baseline Reservoir. The first alternative is to lower Cherryvale Road which should allow more water to overtop the road into Baseline Reservoir. The second alternative is to increase the capacity of the New Anderson Ditch which conveys flow to Baseline Reservoir. This section of the New Anderson Ditch is located on City of Boulder Open Space so the City of Boulder Open Space Department may have issues with this alternative. The ditch company will also have to be consulted to discuss this alternative. At least one diversion structure along the New Anderson Ditch would have to be modified if the capacity of the New Anderson Ditch is increased.

For the public meeting process, the project team will have to be careful when discussing the Levee/ Mainstem Flow Containment alternative. The project team should not present this alternative as a levee which protects the CU South Campus property, which may cause issues the public.

## Hogan/Pancost Property

The Hogan/Pancost Property, located south and east of the East Boulder Community Park, is scheduled for development. At the first public meeting, a number of questions or comments were directly related to the Hogan/Pancost property. It is expected that this property will be topic of discussion with the public at the next public meeting. The public recommended regional detention for this property but the City of Boulder Development Review Team said that regional detention would not work in this area. The recommended plan for this flood mitigation study may include local detention at Manhattan Middle


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

School, located just north of the Hogan/Pancost property. The recommended improvements along Dry Creek Ditch No. 2 for the Hogan/Pancost development are not the same as the recommended plan for any of the best alternative plans for the flood mitigation study but the project team will continue along the same path independent of the recommendations from the development plan.

## Next Steps

Alan Taylor and Alan Turner will set up a meeting with Baseline Reservoir to discuss the possibility of storing more water in the reservoir in the Levee/ Mainstem Flow Containment alternative.

Alan Taylor and Alan Turner will set up a meeting with the ditch companies to discuss the possibility of enlarging the New Anderson Ditch to carry more water to Baseline Reservoir.

The Recommended Plan Workshop is scheduled for August 11, 2010. The project team may have an intermediate meeting to discuss what information will be presented at this workshop and how to best present this information.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #11 Notes

ATTENDEES: Kurt Bauer/City of Boulder, Bob Harberg/City of Boulder, Shea Thomas/UDFCD, Alan Taylor/Alan Taylor Cons, Alan Turner/CH2M HILL, Mark Glidden/CH2M HILL

FROM: CH2M HILL

DATE: July 21, 2010

## Review of Revised Regional Pond Design

### CU Alternatives

Alan Turner described the two concepts and reviewed the summary TM. Concept 1 excludes the Viele Pond from the main channel flow storage. When costs were computed, the cost of the land occupied by the Viele Pond was included. Bob noted this is already a committed ponding area and the land costs should not be assigned to this project. The memo will be revised to eliminate the land cost for this area and to describe the assumptions used in developing the cost estimate.

Concept 2 includes the area of the Viele Pond to help control main channel overflows. The elevation of the embankment is lower, but the berm height is greater because of the revised alignment. The note identifying the spillway location misrepresents the actual spillway location. The spillway will be located along the east end of the embankment to allow overflows to go back to the main channel and not across the west valley. The embankment may also be somewhat exaggerated since improvements to the interchange with Table Mesa Drive could result in a new ramp that could also function as a part of the embankment.

A few comments were offered related to the memo. Figure 3 should include a note that mentions that the ball fields would be subject to flooding and that refinements would probably be necessary during final design. Also, Bob requested an estimate of the volume of cut and fill that would be required to create the developable areas. If this had a significant impact on the cost of the alternatives, these should be understood.

### South Regional Park

The concept developed earlier has been refined to reflect feedback from Open Space. The new layout provides about 420 AF of storage using the two areas identified. There is still a need for pipes to allow ditch flows to pass without interruption but the large box culverts have been replaced with a weir to control flows. The embankment is still 10′ high with an additional 5′ of excavation. While this alternative does not impact the CU South Campus site, it does still require the purchase of some land from the University. This is the antenna site that CU described. Bob asked that the county wetland areas be removed from the drawing. These may not be accurate and could misrepresent actual impacted areas.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Review of Progress on Recommended Plan Workshop

### BCA

CH2M HILL has developed a draft memo describing the results of the work to date. The memo is being reviewed and will be finalized shortly. The evaluation showed a slight increase in the estimated damages. This is attributed to an increase in the assessed values of the properties and a slight change in the flood elevations as a result of the 8M grid. Differences are generally less than 10%. Cost estimates are also being refined to allow the BC analyses to be finalized.

### Modeling

The 8M grid models of 10-, 25- and 50-year floods for the various alternatives are being run. We have asked Eric to do a QC review of the models and are incorporating his comments. There continue to be surprises when the model results are reviewed but the significance of these is generally pretty small.

## Recommended Plan Workshop

The plan will be to conduct the workshop following an agenda similar to the last workshop. We will review work to date and develop a matrix of the Best Alternative Plan Evaluation. This will allow a simple comparison of the alternatives. More detail of the evaluations will then be provided. The intention of the workshop will be to identify the stakeholders' interests so that a recommended plan reflects the group's collective desires. The agenda will be updated to reflect more discussion regarding what should be taken forward to the public. It should also be clear that this will not be the recommended plan until public input has been gathered.

## Next Steps/Meetings

The workshop is scheduled for August 11. Information needs to be distributed to the stakeholders the week prior.

Meetings with the ditch companies and the Baseline Reservoir representatives need to be conducted prior to the workshop. Alan Taylor is trying to put together a short memo describing the issues related to Baseline Reservoir before the meeting to lay a foundation for discussion. At the meeting with both the ditch company and the reservoir representatives, impacts and mitigation measures need to be discussed.

It was concluded that someone familiar with the ditch companies should be invited to the next workshop. The City staff representative would be a good person to participate.

The public meeting should be scheduled around the last week in August but certainly before Labor Day. The WRAB meeting is scheduled for September 20 and there needs to be time to incorporate any public comment. Kurt was going to find a suitable date.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #12Notes

ATTENDEES: Kurt Bauer/City of Boulder, Alan Taylor/Alan Taylor Consulting, Alan Turner/CH2M HILL, Mark Glidden/CH2M HILL, Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: August 4, 2010

## Review of Meeting with Baseline Reservoir Representatives

The meeting with the Baseline Reservoir representatives was not discussed because all meeting attendees were either at the meeting or are aware of what was discussed at the meeting.

## Recommended Plan Workshop

### Review Handout

CH2M Hill is planning on sending out a handout before the recommend plan workshop. This handout will include the best alternative figures with the aerial image behind the improvements, a best alternatives decision matrix, and a short narrative describing the best alternatives decision matrix. For the Best Alternatives Workshop, scheduled for August 11, 2010, additional information will be presented, including residual floodplain images.

The best alternatives decision matrix will present the project implementation cost, the average annual benefit, the present worth of project benefits, the benefit to cost ratio, water quality impacts, environmental factors, social factors, and other factors. The damage and benefit estimates were been broken down by reach but this will not be presented in the matrix but will be available for discussion at the workshop.

The Stormwater Master Plan alternative will be presented as was presented by HDR although there are a few discrepancies when comparing the recommended storm sewer pipe improvements with existing storm sewer pipes. The MIKE FLOOD Models for the Stormwater Master Plan alternative may not be done by the workshop but CH2M HILL will be able to present a cost/benefit analysis based on some of the other MIKE FLOOD Models that have been completed.

## Recommended Plan Workshop Outline

The recommended plan workshop will begin with a short (5 – 10 minutes) discussion of work to date followed by a discussion of the matrix. A large portion of the meeting will be the discussion of the best alternative plans and possible selection of the best plan. One of the goals of this workshop is to get City of Boulder staff to agree on what the best alternative plan is. It is important that the project team come to a consensus on the best plan before the


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



public meeting. Some of the alternatives, including the mainstem flow containment alternative, will get screened out due to factors discussed in the matrix.

It was suggested that phasing may need to be discussed during the recommended plan workshop in case it comes up during the public meeting. The project team will not bring up phasing during the public meeting but must be prepared for any questions regarding the total cost of each alternative and where the money will come from.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #13 Notes

ATTENDEES: Kurt Bauer/City of Boulder, Shea Thomas/UDFCD, Alan Taylor/Alan Taylor Consulting, Alan Turner/CH2M HILL, Mark Glidden/CH2M HILL, Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: August 18, 2010

## Action Items

- CH2M HILL will provide a projector and laptop for the public meeting.
- Kurt Bauer will develop a draft of the sign in sheets and comment sheets for the public meeting.
- Kurt Bauer will provide refreshments and snacks for the public meeting.
- CH2M HILL will provide a rough draft of the public meeting PowerPoint Presentation to Kurt Bauer by Friday, August 20th.
- CH2M HILL will prepare a list of questions which are expected to be asked at the public meeting and prepare answers to these questions.
- CH2M Hill will prepare the information to be posted on the website prior to the public meeting.
- Kurt Bauer will meet with one of the private property owners impacted by the south regional detention pond.
- Alan Turner will contact Randy Rhodes – Xcel/Wellman
- Alan Turner will contact Brad Dallum – New Anderson Ditch
- Alan Turner will contact the US Fish and Wildlife Service to determine the Preble's Meadow Jumping Mouse habitat boundary

## Review of Meeting with Dry Creek Ditch No. 2 Stakeholders

The ditch company is concerned about the liability associated with accepting flood flows although they might be willing to abandon the ditch to the City of Boulder below South Boulder Road. The ditch still must deliver water to Manhattan Middle School and Flatirons Golf Course. The ditch company agreed that the concept proposed as part of the alternative evaluation is sound and there are no major issues at this time although an agreement will need to be worked out in the future.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Public Meeting

The public meeting will begin with a 35-40 minute presentation followed by question and answer sessions at various stations. The project team agreed that there will be three stations; one for the two detention alternatives, one for the high hazard/critical facilities alternative, and one for the conveyance alternatives (diversion to Bear Canyon Creek, Dry Creek Pipeline, and mainstem flow containment). There will be four boards for the detention alternatives; one to show the CU detention pond, one to show the south regional pond, and two showing the improvements through the West Valley. There will be one board for the high hazard alternative and possibly two boards for the conveyance alternatives. There will also be a board showing the matrix with pros and cons for each alternative. The matrix may also be left on the screen after the PowerPoint presentation is finished. The preliminary plan is to have Alan Turner and Kurt Bauer at the detention station, Aaron Cook at the high hazard/critical facilities station, and Mark Glidden and Alan Taylor at the conveyance stations. Bob Harberg, Shea Thomas, and Annie Noble will float around wherever they are needed.

The presentation will be structured as follows:

1. Bob – Introduction/meeting agenda/meeting intentions (2 slides, 2 minutes)
2. Kurt – Introduce project team/overview of process (3 slides, 4 minutes)
3. Mark – Concept development/alternative development/costs/benefits (4 slides, 6 minutes)
4. Alan – Alternative description/residual floodplains (7 slides, 10 minutes)
5. Kurt – Costs/benefits/pros and cons/ alternatives that dropped out (8 slides, 10 minutes)
6. Kurt – Next steps (2 slides, 2 minutes)

The project team decided that we will not discuss phasing or where the funding will come from during the public meeting unless specifically asked. The project team expects to be asked this question so we should be prepared to answer this question. At this time, the project team must have a better idea of what the preferred alternative is before determining phasing or funding.

The project team will not discuss funding for flood proofing of critical facilities unless specifically asked during the public meeting. Right now, it is unknown whether the funding for flood proofing of critical facilities will be public or private.

The project team will prepare a list of questions which are expected to be asked at the public meeting and prepare answers to these questions. These questions may be related to CU, open space, the Hogan Pancost property, Dry Creek Ditch No. 2, or the Preble's Meadow Jumping Mouse habitat among others.

During a discussion of the questions that are expected to be asked during the public meeting, the project team tried to address the response if the question of "Which alternative do you like best?" was raised. The team consensus was that the CU detention with West Valley improvements alternative made the most sense. Everyone agreed that this response


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

needed to be carefully presented and CH2M HILL agreed to try and include this in the draft Q&A being developed.

## Next Steps/Meetings

This public meeting on September 2, 2010 will be the last public meeting. The public meeting will be followed by a presentation to the Water Resources Advisory Board (WRAB). The project team will make a recommendation to WRAB at this meeting. WRAB will have some time to think about the recommendation before the second WRAB meeting.

Other next steps:

- Kurt Bauer will meet with one of the private property owners impacted by the south regional detention pond.
- Alan Turner will contact Randy Rhodes – Xcel/Wellman
- Alan Turner will contact Brad Dallum – New Anderson Ditch
- Alan Turner will contact the US Fish and Wildlife Service to determine the Preble's Meadow Jumping Mouse habitat boundary

CH2M Hill will prepare the following information to be posted on the website prior to the Public Meeting:

- Simplified agenda/outline
- Alternative figures
- Matrix
- Glossary of terms


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #14Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Alan Taylor/Alan Taylor Consulting
Alan Turner/CH2M HILL
Mark Glidden/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: September 1, 2010

## Action Items

### Review of Meeting Agenda, Rules, and Flow

- Kon Damas will introduce the meeting and will introduce each presenter.
- Alan Turner and Kurt Bauer will be stationed at the detention alternatives.
- Aaron Cook will be stationed at the High Hazard/Critical Facilities alternative.
- Mark Glidden and Alan Taylor will be stationed at the conveyance alternatives (pipelines, SWMP, mainstem flow containment).
- Bob Harberg, Annie Noble, Shea Thomas, and Ken MacKenzie will be floaters who can help out at any station.

### Review of PowerPoint Presentation

- Kon will present slide 3.
- Kurt would like to delete slide 7.
- On slide 6, the text should say that the initial presentation to WRAB will occur in November or December.
- Bob prefers to keep the next steps vague.
- A "Do Nothing" alternative will be added to the presentation to show the existing non-structural methods for flood control that the City of Boulder has implemented.
- The presentation will refer to the two detention alternatives as "Regional Detention at US 36" and "Regional Detention near Highway 93". The project team agreed with this idea but the public meeting boards were already printed and won't be changed for the public meeting.

### Dress Code

Dress code for the public meeting is business casual.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




### Speaker Information

Each member of the project team will have a packet of information that includes the following:

- Glossary of Terms
- Preble's Mouse Habitat Figure
- Small Prints of the Public Meeting Boards (11" x 17")
- PDF of the Public Meeting Presentation
- List of Assignments for the Public Meeting

### Glossary Handout

Alan Turner developed a list of terms with definitions (i.e. critical facilities, open space, flood proofing, benefit to cost ratio, WRAB, detention, etc.). The project will have this list during the meeting but it the list will not be presented at the public meeting. Presenting this list at the public meeting may distract from the purpose of the meeting. This list will be put on the South Boulder Creek website later.

### List of Probable Questions with Answers

The list of probable questions with answers was developed by CH2M HILL for internal project team use. Each member of the South Boulder Creek project team will have this document at the public meeting. Kurt will go through the City of Boulder Communications staff to see if this information can be put on the South Boulder Creek website.

From a technical perspective, regional detention at US 36 or near Highway 93 is still the best alternatives. The project team agreed that an on-line reservoir would not be feasible due to the large dam that would be required to store the entire flood.

The Marshall Road property owners are questioning the detention near Highway 93 alternative due to the presence of high groundwater. Groundwater will have to be considered throughout the study area, not just at the detention pond near Highway 93.

South Boulder Creek cannot be channelized because of critical habitat, open space issues, and the high costs associated with channelization.

### Comment Sheets

Kurt sent comment sheets to the project team. The project team agreed that they were a nice, simple, clean design.

### Preble's Mouse Habitat

Each member of the project team will have a figure showing the Preble's Mouse habitat in the study area. Some proposed improvements would require mitigation of the Preble's Mouse Habitat.

### Arrival Time

The room will be ready at 4:00 PM. The project team agreed to arrive between 4:00 PM and 4:30 PM to have some time to set up.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

The projector screen in the room is small and both the City of Boulder and CH2M HILL will bring a screen. The larger screen will be used for the presentation.

## Next Steps/Meetings

- Public Meeting – 9/2/2010
- A report summarizing the work to date will be completed and submitted to the City of Boulder by October 1st.
- The alternatives will be presented to WRAB in November or December.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #16 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Dave Webster/Boulder County
Alan Taylor/Alan Taylor Consulting
Alan Turner/CH2M HILL
Mark Glidden/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: September 15, 2010

## Public Meeting – Review of Meeting and Comments

From the comment sheets collected at the public meeting, the favorite alternative is detention at US 36 and the least favorite alternative is detention near HWY 93, although this may only represent a small cross section of the community. Kurt Bauer has recorded all of the comments from the comments sheets, grouped the comments, and removed the duplicate comments. The meeting summary should be posted to the South Boulder Creek Flood Mitigation Study website soon. The City of Boulder Communication group may review the meeting summary before it is posted to the website.

Bob Harberg will meet with the director of the City of Boulder Open Space department and the Public Works director to discuss the possibility of a detention pond on open space near HWY 93. The open space near HWY 93 has been designated as sensitive habitat for some species including the Preble's Meadow Jumping Mouse.

Ned Williams, City of Boulder Public Works, suggested looking into the possibility of detention west of HWY 93 and that open space away from South Boulder Creek may not have the same sensitivity as open space directly adjacent to South Boulder Creek.

Dave Webster will meet with the County Commissioners next week. Some of the County Commissioners are concerned about the path forward. Dave asked if WRAB had been involved in the project, and the City responded by saying that Chuck Howe, a WRAB member, has been involved and that the project had been presented at a WRAB meeting. The WRAB has advisory status within the City.

The citizens' advisory group, brought up by the public during the public meeting, was initially formed during the Taggart Study. Typically, UDFCD has not had advisory groups for Master Planning Studies but has had them for design projects. The City of Boulder has had advisory groups for past City of Boulder projects.

## Flood Mitigation Report Progress to Date

The South Boulder Creek Flood Mitigation Report generally follows the typical UDFCD template. The first four sections (Introduction, Study Area Description, Hydrologic


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



Analysis, and Hydraulic Analysis) of the South Boulder Creek Flood Mitigation Report are nearly complete and CH2M Hill is in the process of writing section 5 (Alternative Development), and will begin working on section 6 (Alternative Evaluation). The draft of the first four sections will be sent to the project team by the end of this week. The draft of the first six sections will be complete and sent to the project team for review by the first couple of weeks of October.

Because the floodplain mapping study was very detailed, it has been difficult to pull information from the Floodplain Mapping Study without being too detailed. The goal is to provide enough information within this report to understand each section but not be too detailed with all the information presented in the Floodplain Mapping Study. The Floodplain Mapping Study will be referenced for those who want additional information.

## Next Steps

- CH2M Hill and Alan Taylor will review the City Council Information Packet for questions they receive regarding the public meeting.
- CH2M Hill will provide summary information regarding the land value costs for the detention at US 36 alternative and the other alternatives involving land acquisition.
- Bob Harberg will meet with the director of the City of Boulder Open Space department and the Public Works director to discuss the possibility of a detention pond on open space.
- CH2M Hill will attend the next WRAB Meeting, tentatively scheduled for December.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #16 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Dave Webster/Boulder County
Kon Damas
Alan Taylor/Alan Taylor Consulting
Alan Turner/CH2M HILL
Mark Glidden/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: September 29, 2010

## Public Meeting Debriefing

### Detention near HWY 93 Alternative

The progress meeting began with Kon Damas asking if we received comments on alternatives other than Detention at HWY 93. Although there were a number of people other than those from Marshall, it appeared that they were intimidated to speak up at the public meeting. Although the Detention at HWY 93 alternative was unpopular at the public meeting, it is still an option. At this stage of the project, we are only presenting alternatives and are not to the point where the decisions are made. The City typically prefers to negotiate with land owners or modify the preferred alternative but condemnation has been used a couple of times over the last decade for flood mitigation purposes.

Dave Webster stated that the Marshall residents would prefer to be left along, with no flood mitigation improvements. Dave also stated that the County would get involved if this alternative was selected as a viable alternative. This alternative may include other issues such as the 1041 process and land use issues. Dave expects a public letter from the County within two to three weeks discussing this alternative. Bob Harberg would like the County to wait to issue a public letter because the alternative evaluation report is not complete and the county still has the opportunity to give input over the next couple of months. Dave stated that the County Commissioners want to issue to public letter soon.

### Public Meeting Format

The format of the public meeting was discussed at length at this progress meeting. Using an open house format likely would have resulted in less of a mob mentality, although some members of the public specifically requested to skip the public meeting format and continue with the questions/comments/ answers format. It was suggested that the public meeting format could follow City Council format which includes two-hours for public comment. Other options include small discussion groups and a "self guided tour" detailing the process behind selecting the best alternative plans. Dave Webster stated that Boulder County typically uses an open house format for public meetings.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




For any subsequent public meetings, we need to figure out a way to tell the public; "We've heard you, let's move on". This would allow others, such as those from the West Valley, to comment and ask questions. Any subsequent meeting may begin with the results of voting from the previous public meeting as a starting point.

## Review of Progress on South Boulder Creek Flood Mitigation Report

The first four chapters (Introduction, Study Area Description Hydrologic Analysis, and Hydraulic Analysis) of the South Boulder Creek Flood Mitigation Report have been completed in draft format and sent to the project team for review. The fifth chapter (Alternative Development) of the report is nearly complete and will be sent out for review soon. Chapter six (Alternative Evaluation) is in progress.

## Field Visit with OSMP

The meeting with the City of Boulder OSMP is scheduled for September 30 at 2:00 PM. Kurt Bauer suggested using MapQuest instead of Google Maps to get the correct directions to the meeting spot. Alan Turner will bring a packet of information to the meeting which will include an aerial photograph, topography, land owners, and open space information.

## Review of Out of Scope Work and Approximate Cost

The majority of the out of scope work to date includes work on detention pond alternatives or independent stakeholder meetings. The out of scope work to date adds up to approximately $39,000. Alan provided a letter to Kurt Bauer prior to this meeting detailing the out of scope items and will forward it to Shea Thomas.

## Other Detention Pond Alternatives

Alan Taylor suggested evaluating a series of attenuators, at US 36, South Boulder Road, Baseline Road, and the Golf Course. With this alternative, the flow would be forced to the mainstem upstream of US 36, similar to the Mainstem Flow Containment Alternative with storage at Baseline Reservoir, although in this alternative, the series of smaller ponds would be used to offset the additional peak flow and flow volume being forced to the South Boulder Creek Mainstem instead of forcing the flow to Baseline Reservoir.

Kurt Bauer noted that City of Boulder staff have suggested looking into using the East Boulder Recreation Center land for a detention pond.

Alan Taylor suggested that the parcel to the north of the East Boulder Recreation Center could also be used for a detention pond. This parcel is not open space but open space has looked into acquiring it in the past. According to Alan Taylor, this parcel includes heavy wetlands and does not have a lot of development potential. The City of Boulder Staff will discuss with OSMP staff to see if the owner(s) of this parcel is a willing seller because OSMP staff have had previous discussions with the owner.

Bob Harberg suggested evaluating a combination of a pond near HWY 93 with a pond at US 36. Using a combination approach may reduce the berm height and amount of excavation required to store enough water to prevent overtopping of US 36. For both ponds, the location of excavation and the berm should be off of or near the edge of open space property.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

## Next Steps

- CH2M Hill will have the South Boulder Creek Flood Mitigation Report through chapter six complete and sent for review by the second week of October.
- Kurt Bauer will go on an informal field trip with WRAB members to the project site to receive informal direction about the project. The field trip is preliminarily scheduled for October 7th. Shea Thomas stated that she won't be able to make it on October 7th.
- The South Boulder Creek Flood Mitigation Report will be presented at the December WRAB meeting.
- CH2M Hill will look into the hydraulic feasibility of the new open space detention pond alternative. This alternative is supported by Dave Webster when compared to the Detention at HWY 93 alternative presented at the public meeting.
- The schedule has been updated with a final delivery date of May, 2011. Alan Turner will send the new email to the project team.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #17 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Ned Williams/City of Boulder
Shea Thomas/UDFCD
Dave Webster/Boulder County
Alan Taylor/Alan Taylor Consulting
Alan Turner/CH2M HILL
Mark Glidden/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: November 3, 2010

## Review Progress on South Boulder Creek Flood Mitigation Report

CH2M Hill has incorporated comments from Kurt Bauer and Shea Thomas on sections one through five of the South Boulder Creek Flood Mitigation Report. Alan Turner will contact Kurt Bauer regarding a few questions on Kurt's comments. CH2M Hill is finished with section six of the South Boulder Creek Flood Mitigation Report with the exception of Alternative 9. The project team determined that CH2M Hill will submit section six once Alternative 9 is complete and incorporated into the report. CH2M Hill will submit section 6 by Thanksgiving.

## Review and Discuss Alternative 9 Feasibility

Alternative 9 is a derivative of the mainstem flow containment alternative which forces all the flow from upstream of US 36 through the US 36 bridge over South Boulder Creek. The mainstem flow containment alternative forces approximately 210 acre-feet of additional water to the mainstem of South Boulder Creek which must be mitigated downstream. Kurt Bauer questioned why the project team was evaluating detention pond alternatives upstream of US 36. The project team is evaluating options upstream of US 36 because it is likely that more than 210 acre-ft of storage will be needed because the ponds are in series and storage upstream of US 36 lessens the impacts at US 36. The alternatives will be evaluated in Mike Flood to determine if storage upstream of US 36 is necessary to help mitigate the additional volume of water being forced to the mainstem.

### Storage at US 36

Detention immediately upstream of US 36 provides approximately 131 acre-feet of additional storage when compared to the regulatory model. Because storage upstream of US 36 was included in the mainstem flow containment alternative, this storage cannot be counted towards the 210 acre-feet of water being forced to the mainstem of South Boulder Creek. For this alternative, the berm ties into the US 36 Bridge over South Boulder Creek and wraps around parallel to the CU berm.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




### Storage at South Boulder Road

The detention pond at South Boulder Creek is created by either raising South Boulder Road or constructing upstream of South Boulder Road. The current plan includes a berm with a height of 5 feet above the existing elevation of South Boulder Road. Flood storage would be up to a height of 3 feet above the existing elevation of South Boulder Road with the remaining 2 feet left for a spillway and freeboard. This detention pond provides an additional 130 acre-feet of storage. To protect the private property to the west, the berm must wrap around between Dry Creek Ditch #2 and the Viele Ditch. The berm on the west side is approximately 2 – 3 feet high.

The South Boulder Road detention pond figure included in the Technical Memorandum *South Boulder Creek – Alternative 9 Detention Ponds* shows a ponded depth up to 14 feet because there is already storage at South Boulder Road in the existing conditions. The proposed detention pond is created by raising South Boulder Road to provide additional storage. The project team recommended that the figure also show the areas that will be flooded in the proposed conditions that are not flooded in the existing conditions.

### Storage at the Granite Property

There are two alternatives for storage on the Granite Property. The first option is an 18 foot berm with 15 feet of flood storage and 3 feet for a spillway and freeboard. The total storage for this alternative is 93 acre-feet. The problems with this alternative are the large berm and the length of the horseshoe shaped berm. The second alternative includes two detention ponds in series, each with a maximum berm height of 11 feet with 8 feet of flood storage. The total storage for the second alternative is approximately 54 acre-feet. Both of the alternatives assume no excavation on the Granite Property.

Flood waters would enter detention ponds on the Granite Property via a channel from the mainstem of South Boulder Creek. Outflows from the detention ponds would be conveyed via a new open channel back to South Boulder Creek.

### Storage on Open Space between US 36 and Highway 93

The proposed detention pond on open space between US 36 and Highway 93 has no impact to private property, property owned by the University of Colorado, or high quality wetland areas and includes no excavation on open space property. With a 17 foot berm height, 14 feet for flood storage and 3 feet for a spillway and freeboard, the total storage is approximately 146 acre-feet. The discharge from this detention pond is through the existing ditch systems and a spillway back to South Boulder Creek.

### Storage between Highway 93 and Marshall Road

The wedge shaped detention pond between Highway 93 and Marshall Road has a 12 foot maximum berm height and 35 acre-feet of storage. This pond is identical to the small part of the two stage detention pond presented at the second public meeting. This detention pond includes excavation.

### Summary

The total storage within the project area ranges from 365 to 404 acre-feet depending on which detention pond alternative is selected at the granite property. Because the total storage is greater than the 210 acre-feet being forced to the mainstem of South Boulder


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

Creek, this alternative is feasible to mitigate the additional volume. Alternative 9 will have to be evaluated in Mike Flood to confirm that mitigation of 210 acre-feet of water is possible.

### Questions on Detention Pond Alternatives

Bob Harberg questioned why the berm at US 36 doesn't extend to the bridge deck at South Boulder Creek. In the mainstem flow containment alternative, the berm does extend to the bridge deck elevation but the water surface elevation never reaches that elevation so a berm to that height is not necessary.

Alan Taylor suggested a berm at Baseline Road similar to the berm at South Boulder Road. This detention pond could include low head culverts to direct the outflow to open space and away from private properties. Bob Harberg questioned why this alternative was not previously considered. One of the reasons this site was not considered for a detention pond was that City of Boulder Open Space has been trying to acquire the Granite Property and suggested a detention pond on that property. A berm/detention pond at Baseline Road may be more favorable than a pond on the Granite Property due to the height and length of the berm required on the Granite Property.

CH2M Hill will evaluate the feasibility of a detention pond at Baseline Road and report back to the project team. This option would likely keep Baseline Road open to traffic during the 100-year storm event.

The question was asked whether it would beneficial to move the detention pond on open space between US 36 and Highway 93 further to the North. The project team agreed that a 17 foot berm is too large and that a 10 – 12 foot berm would be more realistic. Kurt Bauer suggested CH2M Hill evaluate the detention ponds downstream of US 36 in Mike Flood to determine if storage upstream of US 36 is necessary. CH2M Hill will complete the Mike Flood analysis of Alternative 9 prior to showing the preferred Alternative 9 to City of Boulder Open Space representatives.

## Staff Recommendations on Next Steps with SBC Flood Mitigation Report

### Next Steps

- CH2M Hill will submit section six of the South Boulder Creek Flood Mitigation Report by Thanksgiving. Section six will include Alternative 9.
- CH2M Hill will evaluate the feasibility of a detention pond at Baseline Road and report back to the project team.
- CH2M Hill will evaluate Alternative 9 in Mike Flood.
- A progress meeting is scheduled for November 10, 2010. Kurt suggested moving this progress meeting until after the Mike Flood analysis is complete. Additional progress meetings will be scheduled for November 12, 2010 and November 17, 2010 for flexibility depending on when the Mike Flood analysis is complete.

### WRAB Schedule:

- The WRAB meeting is scheduled for December 14, 2010.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



- The final packet of information must be submitted to WRAB members by December 6, 2010 to give them one week to review the information submitted.
- The draft packet of information should be submitted to the City of Boulder by November 30, 2010 for City review and the City would prefer to get this information prior to Thanksgiving (11/25/2010).


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #19 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Ned Williams/City of Boulder
Shea Thomas/UDFCD
Dave Webster/Boulder County
Alan Taylor/Alan Taylor Consulting
Alan Turner/CH2M HILL
Mark Glidden/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: November 3, 2010

## Review Alternative 9

The total cost for Alternative 9 is approximately $29,500,000. This cost includes land acquisition for the Granite Property and purchase of open space equal to the berm bottom width plus 15 feet. This cost does not include land acquisition for additional inundated areas. The City of Boulder will discuss the land acquisition for inundated areas with the City of Boulder Open Space Department. The total cost also includes all West Valley improvements. The residual floodplain shown is approximate and may change.

### Detention near Highway 93

With the limitations of the pond on open space near Highway 93, including no excavation and a berm height of less than or equal to ten feet, it was determined that a detention pond near Highway 93 had little impact on reducing the peak flow or volume along the mainstem as is not included in this alternative.

### Detention at US 36

The maximum berm height is 13 feet with a maximum pool depth of 17 feet and an approximate additional storage of 130 acre-feet. The berm is completely separate from CU berm.

This detention pond requires a control structure to reduce the flow through the US 36 Bridge and allow for more storage upstream of US 36. This control structure could be combined with the CDOT bike path which is tentatively planned to be placed directly upstream of US 36. At this time, CH2M Hill does not have additional information about this structure.

Ned Williams is concerned about the public policy of choking the flow at the US 36 Bridge. If the control structure is placed upstream of US 36, the flow wouldn't be choked at US 36, it would be choked upstream. Bob Harberg would like more information about this structure before a final decision can be made.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




Due to the sensitivity of the Table Mesa Pond, the Viele Channel on the CU South Campus must still be improved to collect and convey flows. The City of Boulder can perform channel improvements without having to negotiate with CU.

### Detention South Boulder Road

The berm height is 6 feet above South Boulder Road with a maximum pool height of 4 feet above South Boulder Road. The maximum depth of storage is approximately 13 feet and the total additional storage is approximately 130 acre-ft. The spillway for this detention pond is to the east of the mainstem of South Boulder Creek. Downstream of the detention pond at South Boulder Road, the Viele Channel must be improved to collect and force flows towards the mainstem of South Boulder Creek. Flows overtopping the Viele Channel flow towards the East Boulder Recreation Center.

### Detention at Baseline Road

The berm height is 10 feet above Baseline Road with a maximum pool height of 7 feet above Baseline Road. The maximum pool depth is approximately 13 feet with an approximate additional storage of 295 acre-feet. This detention pond may require the purchase of the Granite Property due to additional inundation caused by the berm. With the detention ponds at US 36, South Boulder Road, and Baseline Road, approximately 70% of the structures on Gaptor Road are seeing an increase of less than 2 inches in flood depth from the regulatory model. This alternative may also reduce the frequency at which these structures along Gaptor Road are flooded.

The detention pond at Baseline Road impacts a parking lot and trail head. The City of Boulder stated that a cost to relocate the parking lot and trailhead should be included in the cost estimate for the distributed regional detention alternative.

## WRAB Meeting Preparation

The alternatives that will be suggested at the WRAB Meeting for further investigation are as follows:

- No Action
- High Hazard/Critical Facilities Protection
- US 36 Detention
- Alternative 9 (Distributed Regional Detention)

The other alternatives will not be evaluated in further detail.

## Additional Public Outreach

The Open Space Board Presentation is scheduled for January, 2011. This presentation will be similar to the presentation at the WRAB meeting. Don D'Amico/City of Boulder Open Space will present a 5 minute presentation regarding the South Boulder Creek Flood Mitigation Study on December 10, 2010.

## Next Steps

CH2M Hill will the following items to the City of Boulder:

- Draft figures to be used in the WRAB Presentation
- Cost/benefit analysis for Alternative 9 by Thanksgiving
- Alan Taylor will look into the pros and cons for Alternative 9


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

- Chapters 1 – 6 of the report in draft format
- The additional flow forced to Baseline Reservoir in the distributed regional detention alternative
- The assessed value of the Granite Property to be used in the distributed regional detention alternative
- CH2M Hill will summarize the cost spreadsheets into major elements


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study - Progress Meeting #20 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Don D'Amico/City of Boulder
Shea Thomas/UDFCD
Alan Taylor/Alan Taylor Consulting
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: December 8, 2010

## Review Report Status

The following list shows the progress on the South Boulder Creek Major Drainageway Plan – Alternative Analysis Report:

- The draft report has been reviewed by the City of Boulder and UDFCD.
- Alan Turner proposed to remove Appendices B and C and reference previous reports in the flood mapping study for hydrologic and hydraulic information. The City of Boulder and UDFCD agree that Appendices B and C can be removed.
- Appendix F will include the grading plans for the detention pond alternatives.
- Kurt Bauer stated that the figures in Chapter 7 are difficult to read. The figures were presented in this format to be consistent throughout the report. Both UDFCD and the City of Boulder agreed that the figures in Chapter 7 can be left as is.
- Kurt Bauer likes the updated executive summary.
- CH2M HILL will include the list of critical facilities in the appendices.
- CH2M HILL will make the necessary changes to the report and send to Kurt Bauer. Kurt will put the report of the project website and others can download the report there. Kurt wants the report on the website by the end of the week.

## WRAB Meeting Preparation

The memo from Kurt Bauer to WRAB is going on the website today. The memo was reviewed by CH2M Hill. Kurt is going to call the Swanstroms and Militzers to let them know of the recommendations to WRAB.

Kurt Bauer will go through a dry run of the presentation on Friday with City of Boulder staff. The presentation will be approximately 20 minutes long. Kurt Bauer will present at the WRAB meeting and CH2M HILL will be available for a question and answer session.


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



Kurt will send the PowerPoint presentation to CH2M HILL before the WRAB meeting for reference. CH2M HILL will bring figures for each alternative to the WRAB meeting.

Shea Thomas will not attend the WRAB meeting. Don D'Amico and Annie Noble will attend the public meeting. Annie will arrive late as she has another public meeting that day.

The WRAB meeting starts at 7:00 PM. Kurt Bauer and CH2M HILL will arrive around 6:00 PM. The dress code for the meeting is business casual.

## Additional Public Outreach

The presentation to the City of Boulder Open Space Board will occur in January. The presentation will be similar to the one that will be presented at the WRAB meeting, with additional specific information focused on impacts to open space. Kurt and Don will work together to determine the specific information to present to the Open Space Board. Don stated the agenda for the January Open Space Board is full and isn't sure how much time will be dedicated to the South Boulder Creek flood mitigation project. Don will pass this information on to the project team once the agenda becomes available.

## Next Steps

The WRAB meeting presentation and presentation to the Open Space Board in January are the next major milestones. The project team will wait for feedback from these two presentations to move on with further analysis of the selected alternatives. Alan Turner will update the schedule to include the WRAB meeting and the Open Space Board presentation.

Kurt Bauer needs the out of scope items amendment from CH2M HILL. CH2M HILL is almost ready to send this information to Kurt.


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Phase II Kickoff Meeting

ATTENDEES: Kurt Bauer / City of Boulder
Shea Thomas / UDFCD
Mark Glidden / CH2M HILL

COPIES: Bob Harberg / City of Boulder
Annie Noble / City of Boulder
Aaron Cook / CH2M HILL
Alan Taylor / Alan Taylor Consulting
Mark Taylor / Architerra

FROM: Alan Turner / CH2M HILL

DATE: June 9, 2011

PROJECT NUMBER: 400168

## Introduction

This meeting was to discuss schedule and to set up milestones and goals for the second phase of the South Boulder Creek Flood Mitigation Project.

1. Accepted Work Plan
    a. Complete review and analysis of OSMP Memorandum compared to proposed alternatives – ***CH2M HILL***
    b. Refine easement analysis based on existing alternatives – ***Alan Taylor Consulting***
    c. Identify utility conflicts and proposed solutions – ***CH2M HILL***
    d. Collect existing information regarding irrigation flows to ensure alternatives are sized correctly for decreed flows. – ***Alan Taylor Consulting***
    e. Identify proposed flood proofing alternatives– ***Alan Taylor Consulting***
    f. Create a preliminary rendering of a berm for review - ***Architerra***
    g. Progress meeting Wednesday, June 20, 2011 10:30 am
        i. Review results of task a – f above





    h. Begin refinement of alternatives based on above information
        i. Collection system for Bear Canyon Creek Pipeline
        ii. Refined conveyance facilities for Dry Creek #2 Ditch
            1. Pipeline
            2. Open Channel
        iii. Refined control structure for US 36 flow split
    i. Workshop meeting July 20, 2011
        i. Will include Architerra to review landscape perspectives
        ii. Review refinements to date and make changes based on City and UDFCD Comments
    j. Final Refinement of alignments based on updated easement information
    k. Final Refinement of utility conflicts and preparation of conceptual relocation plans
    l. Phasing analysis and incremental benefits evaluation
    m. Update of Cost Benefit analysis based on refinements
    n. Final workshop meeting August 17, 2011
        i. Review final alternatives
    o. Prepare final report text
    p. Tentative OSMP Meeting September, 2011
2. Action Items
    a. CH2M HILL will work with Architerra and Alan Taylor to begin initial work on South Boulder Creek Refinements.
    b. CH2M HILL will call Xcel Energy and QWEST to attempt to recover atlas sheets for phone, gas and electricity in the vicinity of the improvements.
3. Schedule
    a. Begin Work June 6, 2011
    b. Progress Meeting Jun 20, 2011
    c. Workshop Meeting July 20, 2011
    d. Progress Meeting August 3, 2011
    e. Workshop Meeting August 17, 2011
    f. OSMP Meeting September 2011

# SBC Flood Mitigation Study - Progress Meeting #23 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Alan Taylor/Alan Taylor Consulting
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL

FROM: CH2M HILL

DATE: August 3, 2011

## Distributed Detention Changes and Update

The detention pond upstream of US-36 in the distributed regional detention alternative has been modified. The revised detention pond provides off-line storage that allows the detention ponds at South Boulder Road and Baseline Road to function without overtopping. The detention pond was previously modeled, in MIKE FLOOD, as a culvert along the mainstem of South Boulder Creek, but it was agreed upon that a structure along the mainstem would not be possible.

The new control structure is between the mainstem of South Boulder Creek and the west overbank. The detention pond is designed such that approximately 1,000 cfs will remain in the mainstem of South Boulder Creek with any flows exceeding 1,000 cfs allowed to flow into a lowered west overbank and into the detention pond. The berm, which previously tied into the US-36 bridge over South Boulder Creek, now extends to the south keeping the flow in the mainstem separate from the flow in the lowered overbank. The first 1,000 to 2,000 cfs reaching the pond would flow directly through the culvert outlet structures, back to the mainstem of South Boulder Creek. The detention pond begins to store water only at higher flows.

The additional length of the berm increases the impact to open space property and critical habitat. The additional berm does not impact the trail system adjacent to South Boulder Creek but may provide a visual barrier to trail users looking to the west, especially near US-36 where the height from the trail to the top of the berm is at a maximum.

## Review of Open Space Memorandum

The open space memorandum made a few key assumptions that are not consistent with the assumptions made by the South Boulder Creek Flood Mitigation Study project team. A few of the key difference in assumptions are:

- Open space assumed the berms were entirely on open space land. The Flood Mitigation project assumed the berms would be placed partially on City or State Right of Way.


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




- For the Distributed Regional Detention alternative, the open space memorandum stated the maximum berm height at US-36 is 18 feet. The actual maximum berm height is 12 feet.
- For the Distributed Regional Detention Alternative, the open space memorandum stated the maximum berm height at Baseline Road is 18 feet. The actual maximum berm height is 18 feet but only if measured from the South Boulder Creek invert to the top of the berm.
- In general, the estimated impacts to open space and critical habitats are less than what was reported in the open space memorandum, although the impacts to open space and critical habitat are greater than what was reported for the detention pond at US-36 for the Distributed Regional Detention alternative where the berm was extended to the south.

Alan Turner/CH2M HILL will finalize the memorandum detailing the inconsistencies between the South Boulder Creek Flood Mitigation Project and what was presented in the open space memorandum.

## Review of Renderings and Rendering Locations

The Architerra Group has prepared two renderings showing the impacts of the proposed berms. The renderings they've prepared are:

- Distributed Regional Detention Alternative – Looking southwest from the corner of Baseline Road and Cherryvale Road
- Storage at US-36 Alternative – Looking south from Table Mesa Drive overpass to University of Colorado south property

The Architerra Group will prepare two additional renderings:

- Distributed Regional Detention Alternative – From trail adjacent to South Boulder Creek (upstream of US-36) looking northwest
- Storage at US-36 Alternative – From trail adjacent to South Boulder Creek (upstream of US-36) looking northwest

Bob Harberg requested that the view of each of the renderings be expanded to 180° to show a better representation of the proposed improvements. Alan Turner will coordinate with Kurt Bauer if the two additional renderings to not fit within the existing budget for Architerra.

## Utilities Conflict Updates

CH2M HIILL has not been able to contact Qwest or Xcel for utility line locations but will include a contingency for utility conflicts. Actual locations and utility conflicts can be pursued at a later date such as conceptual design.

## Alternative Phasing Strategy

The goal is to develop a phasing plan that the city can implement and identify ways to get the projects funded. A preliminary phasing plan was presented to the project team for each


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

alternative but CH2M HILL will have to evaluate the final costs and benefits before recommending a final phasing strategy. In general, the phasing considerations are:

- Benefit/cost analysis
- Capital cost
- Relationship to other improvements
- Traditional downstream to upstream approach

The benefits are mostly clear for the larger improvements but become less clear for the smaller improvements. When the benefit/cost analysis becomes difficult, a traditional downstream to upstream approach should be used.

## Updated Cost Estimates

The cost for the Bear Canyon Creek pipeline alternative has been updated to include the cost for the inlets and lateral pipelines where flow overtops US-36. The updated cost estimate is approximately $4,000,000 higher than the previous estimate.

CH2M HILL would like to include a more detailed cost estimate for the construction of detention pond berms and is currently working on this. One idea is to determine a cost per linear foot of jurisdictional berm based on estimates from CWCB or other consultants.

## Discussion of Current City of Boulder Terrain Files

The terrain data that the project team has been using for the South Boulder Creek Flood Mitigation Project is not the most current terrain data from the City of Boulder. At the onset of the project, the City loaded the old terrain data to the City of Boulder FTP site, which is the data that the project team has been using.

In the 2003 survey, vegetated cover prevented gathering proper topography in some stream areas. Merrick & Company was hired to correct the topography in stream areas using LIDAR. The topography corrected in stream areas was never loaded to the City of Boulder FTP site.

The City just recognized this issue and both the Floodplain Mapping Study and Flood Mitigation Project have used the old terrain data. The difference between the corrected and not corrected topography is generally less than 0.5 feet but can be as much as 2 – 4 feet in isolated areas.

CH2M HILL is in the process of contacting Eric Fontenot/DHI to determine which topography was used for the Floodplain Mapping Study in the MIKE FLOOD Model. CH2M HILL has continued to use the same topography in MIKE FLOOD for each alternative that was modeled. CH2M HILL will also perform an analysis to determine the difference between the corrected and not corrected topography for the South Boulder Creek project area.


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study –Progress Meeting #24 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/ City of Boulder
Annie Noble/ City of Boulder
Shea Thomas/UDFCD
Alan Taylor/Alan Taylor Consulting
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Mark Taylor/Architerra

FROM: CH2M HILL

DATE: August 31, 2011

This meeting summary documents the discussion and major decision made during Progress Meeting 24.

## Review of Refined Costs and Comparison of Plan Costs

The costs for each alternative were refined by evaluating each element within each alternative plan. Unit costs, construction costs, land acquisition, wetland mitigation, etc. were refined for each alternative. The major changes to the cost estimates include:

- Included environmental mitigation
- More detail and a better understanding of the detention ponds footprints
- Better understanding of required land acquisition
- Contingency decreased from 50% to 35%

**High Hazard and Critical Facilities Alternative**: CH2M HILL and Alan Taylor are still working on the refined costs for this alternative. Alan Taylor is working on the unit costs for floodproofing Frasier Meadows Manor, schools, and gas stations. The project team determined that only the cost for mitigating the high hazard zone should be included in this alternative. The costs for floodproofing of critical facilities will be noted but it will not be a cost to the City of Boulder.

**Storage at US-36 with Downstream Improvements Alternative**: This alternative was divided into three elements for consideration in the phasing recommendation; detention pond at US-36, improvements in the West Valley, and detention at Arapahoe Avenue. The increase in cost for this alternative is due to a better understanding of the detention pond footprint at US-36 (with 4:1 side slopes and an impervious core key trench), additional riprap for the US-36 detention pond spillway, and a better understanding of the environmental mitigation required for the channels downstream of the Arapahoe Avenue detention pond. Environmental mitigation, which was not included in the previous cost estimate, was included in the refined costs.


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




**Distributed Regional Detention with Downstream Improvements Alternative**: This alternative was divided into three elements for consideration in the phasing recommendation; regional detention ponds, improvements in the West Valley, and detention at Arapahoe Avenue. The increase in cost for this alternative is due to the following:

- Computational problems in previous spreadsheet (contingency not applied correctly, mistake in applying detention pond equation) (approximately $4 million)
- Added environmental mitigation (approximately $4 million)
- Increase in property acquisition cost (approximately $4 million)
- Increase in spillway and earthwork cost for detention ponds (approximately $5 million)

**Bear Canyon Creek Pipeline Alternative**: The property acquisition and wetland mitigation costs increased but the overall pipeline refinement decreased the overall cost for this alternative.

## Cost Benefit / Phasing

The goal of the phasing plan is to offer direction as to how the facilities, as part of the overall alternative, should be implemented. The phasing considers benefit to cost ratio, capital cost, and other intangibles such as life safety, flood control, and public interests. The final phasing will require input from the City of Boulder and UDFCD.

**Storage at US-36 with Downstream Improvements Alternative:** For this alternative, the recommended phasing is as follows:

1. Detention pond at US-36 (favorable benefit to cost ratio, capital cost not too much higher than other improvements, prevents overtopping of US-36)
2. West Valley Improvements (high benefit to cost ratio, doesn't eliminate 100-year floodplain)
3. Detention pond at Arapahoe Avenue (favorable benefit to cost ratio)

**Distributed Regional Detention with Downstream Improvements Alternative:** For this alternative, the recommended phasing is as follows:

1. Detention pond at Arapahoe Avenue (favorable benefit to cost ratio, downstream to upstream improvements)
2. Distributed regional detention ponds (benefit to cost ratio less than one, prevents overtopping of US-36)
3. West Valley Improvements (high benefit to cost ratio, doesn't eliminate 100-year floodplain)

**Bear Canyon Creek Pipeline Alternative**: For this alternative, the recommended phasing is as follows:


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

1. Detention pond at Arapahoe Avenue (favorable benefit to cost ratio, downstream to upstream improvements)
2. Bear Canyon Creek Pipeline/Inlets (favorable benefit to cost ratio, captures flow overtopping US-36, eliminates 100-year floodplain)
3. West Valley Improvements (favorable benefit to cost ratio, eliminates 100-year floodplain)

The costs for each of the three alternatives, Storage at US-36 with Downstream Improvements, Distributed Regional Detention with Downstream Improvements, and Bear Canyon Creek Pipeline Alternative, have a favorable benefit to cost ratio with the refined costs but not every element within each alternative has a favorable benefit to cost ratio.

## Renderings

Mark Taylor presented three photos showing the view from the trail upstream of US 36. These photos were taken with the intent of showing the berms for the detention ponds upstream of US-36 for both the Storage at US-36 alternative and the Distributed Regional Detention Alternative. From the vantage points that the three photos were taken, it would be very difficult to show either of the berms. The berms are either blocked by vegetation or are too far away. For now, Architerra will leave the photos as is without creating a rendering of the berms.

Mark Taylor also presented the rendering of the US-36 berm at the CU South Campus (taken from Table Mesa Drive) with a widened view.

## Terrain

## Report Chapters and Outlines

## Schedule


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

**This Page Intentionally Left Blank**

Appendix A-2

# Workshop Meeting Minutes

**This Page Intentionally Left Blank**

# South Boulder Creek Flood Mitigation Study Preliminary Plan Element Identification Workshop Meeting Notes

**ATTENDEES:**

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Don D'Amico/City of Boulder Open Space
Ned Williams/City of Boulder Public Works
Ken MacKenzie/UDFCD
Jeffrey Lipton/CU-Boulder
Chuck Howe/Boulder Water Resources Ad. Board
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting
Kaia Anderson/Anderson & Co., Inc.
Steven Griffin/CDOT
Bob Hays/CDOT
Mark Nelson/USACE
Chris Fassero/USACE
Kayla Eckert Uptmor/USACE

**FROM:** Aaron Cook

**DATE:** February 3, 2010

**PROJECT NUMBER:** 400168

## Welcome/ Introductions/ and Background Information

The 2008 floodplain delineated with MIKE FLOOD is expected to be adopted by FEMA in 2011. A risk assessment was performed along with the floodplain delineation. There is a substantial difference between the 2008 floodplain and the regulatory floodplain in terms of flooding in the West Valley. The existing regulatory floodplain is only along the mainstem of South Boulder Creek. The 2008 floodplain study also includes a high hazard zone (extreme depth, extreme velocity, or a combination); defined as where the product of velocity and depth is greater than 4 $ft^2/s$ or the depth is greater than 4 feet, and a conveyance zone, which is a 0.5-foot floodway.

The City of Boulder has contracted with CH2M HILL for a Flood Mitigation Study in the West Valley. Representatives from the City of Boulder stated that full 100-year containment is only a possibility when substantial money comes in from an outside source. Instead of mitigating the 100-year floodplain, the City mitigates the high hazard zone. Previously, the City would contain the 100-year flow and remove the 100-year floodplain from development, but recent City Council direction has shifted the focus to the high hazard zone. At this stage, floodplain mitigation in the West Valley will remain an objective in addition to high hazard zone mitigation.

The United States Army Corps of Engineers (USACE) is also performing a reconnaissance study along South Boulder Creek. The USACE wants to develop a one dimensional HEC-RAS model calibrated to the results of the MIKE FLOOD model. The City of Boulder has


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



attempted to develop a calibrated HEC-RAS model with multiple flow paths in the past with little success. CDOT expressed concerns about using MIKE FLOOD to model hydraulics within the study area. It was noted that in MIKE FLOOD, the channels are represented as one dimensional elements (MIKE 11) which may help in developing HEC-RAS models or real-time models.

CDOT performed an Environmental Impact Statement in the study area, which assumed all flows were conveyed through US Highway 36 instead of breaking out of the main channel as is shown in the MIKE FLOOD model.

## Summary and Goals of South Boulder Creek Flood Mitigation Project

The project team has a good idea of where the problems are within the study area. The scope of work for CH2M HILL is to mitigate the flood threats by blending the typical UDFCD approaches with refinements made possible by the tools being used and the knowledge of the study area.

The goal of this meeting was to review known flood hazards, to understand issues and constraints for mitigation alternatives, to get input from stakeholders, to understand ongoing projects (USACE, CDOT) within or near the study area, and to develop a suite of potential elements to address the flood hazards. The project team will then begin to look at potential alternative elements in more detail.

A second workshop will be held in the future to discuss possible alternative elements in more detail and reduce the number of alternatives. A series of alternative plans will then be developed to address flood hazards in the West Valley. The combined benefits of each plan will be evaluated and a few plans will be selected as the Best Alternative Plans for analysis in MIKE FLOOD. A cost-benefit analysis will be performed on the Best Alternative Plans to select the Recommended Plan.

The public will be involved in the alternative selection process. Two public meetings will be held throughout the project, one during the alternative plan development stage and one during the process to define the recommended plan.

## Review of Study Area Limits

The study limits for this flood mitigation project are limited to the West Valley. This project will not necessarily address issues with the South Boulder Creek mainstem, but the mainstem cannot be completely disregarded due to the interactions between the mainstem and the West Valley downstream of US Highway 36. The majority of the mainstem of South Boulder Creek is outside the City of Boulder limits, within Boulder County. To date, Boulder County has not expressed interest in improvements along the mainstem. The USACE project has a broader view than the West Valley.

There are two centerlines for flow in the West Valley, one along the Dry Creek drainage and 55th street (East of Foothills Parkway), and one West of Foothills Parkway. Each centerline represents a reach in the development of alternatives. A third reach has been defined as the mainstem upstream of US Highway 36 where improvements could reduce the flood hazard in the West Valley.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

The study area includes the C-2 basin. The C-2 basin is a tributary basin to South Boulder Creek and was included in the MIKE FLOOD model as a series of distributed loading points throughout the West Valley. In the hydrology stage, the C-2 basin was subdivided into five basins so there are five loading points in the West Valley.

Within the West Valley, there is little open space although there are city owned properties such as East Boulder Community Center and The Flatirons Golf Course within the West Valley. Considerations will also have to be made for the Preble's Meadow Jumping Mouse habitat upstream of US Highway 36.

### Identification of Flooding Problems

Based on the South Boulder Creek Floodplain/Flooding animation, the first flooding issues in the West Valley come from the C-2 loading points, flows from the Wellman Ditch/Bear Canyon Creek, and the New Anderson Ditch. Later in the simulation, the C-2 loading points start to overtop infrastructure and the mainstem starts to break out upstream of US Highway 36. At this time, there are also breakouts from the mainstem towards the West Valley. There are flooding issues in the West Valley before the West Valley flooding is associated with the flows overtopping US Highway 36. Later in the simulation, there is a breakout from Dry Creek Ditch No. 2 into the West Valley and US Highway 36 overtops. The flows overtopping US Highway 36 (approximately the 50-year flow overtops US Highway 36) become the second wave of flooding in the West Valley. At this time, the interaction between the West Valley and the mainstem begins. The final flooding problem identified in the West Valley is a flow split at the Baseline Road and Foothills Parkway intersection and flooding down Foothills Parkway.

Most of the damage estimated during the risk assessment was to properties within the West Valley, specifically those properties with basements. For the 100-year storm, there is $180 million in damages to the West Valley and $35 million in damages along the mainstem. For the 10-year storm, there is $18 million in damages to the West Valley and $11 million in damages along the mainstem. The majority of the damages associated with the mainstem are along Gaptor Road. The high hazard zone within the West Valley is mostly limited to streets.

### Discussion of Known Constraints from Project Stakeholders

**CDOT – US Highway 36**

There is a number of potential CDOT wetland mitigation sites located within the project area. The potential CDOT wetland mitigation sites were provided to CDOT by the City of Boulder and include but are not limited to the following:

- Near the confluence of South Boulder Creek with Boulder Creek
- South of Baseline Road, west of South Boulder Creek
- North of Recreation Center
- South of CU Property

The City of Boulder is not locked into any of these wetland mitigation sites, but CDOT needs 13 acres of wetland mitigation within the area. According to Don D'Amico, a representative from City of Boulder Open Space, the City cannot construct detention on


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



high quality open space lands. City of Boulder Open Space also acknowledged that more frequent inundation of open space lands would likely be an ecological benefit, as it would replicate historic flooding conditions. The project team will look into a combination of uses within the study area such as improving the channel and providing a wetland habitat area. Danielle Yearsley/CH2M HILL is a good resource regarding the improvements to US Highway 36.

**USACE Reconnaissance Study**

The USACE has performed a Reconnaissance Study on South Boulder Creek and is preparing to move forward with the Feasibility phase. To finalize the Reconnaissance Study phase, the USACE needs a Letter of Intent from the City of Boulder. The cost of the Feasibility Phase to the City of Boulder would be approximately $2.5 Million, which is a 50/50 cost share with Federal Funds. The advantage to the City of Boulder collaborating with the USACE for the Feasibility Study is the potential cost savings during construction of recommended improvements.

**CU Property**

The CU property is 308 acres and was a former gravel mine. A Conceptual Land Use Assessment was created for the CU property but the development of the property is still in the conceptual phase and there is a lot of flexibility in the plan. The conceptual plan includes areas for buildings, wetlands, natural area, flood storage, and ponds. The wetland areas located within the South CU campus can be moved as this site is still considered a reclamation site. CU is willing to cooperate with the flood mitigation project. If a portion of the CU property is used for flood storage, CU would like the City to consider providing CU with connections to water and sewer lines.

### Identification of Potential Solutions

A matrix of identified problem areas versus potential solutions was presented for each reach. Reach 1, South Boulder Creek above US Highway 36, was eliminated as a reach, and the potential solutions above US Highway 36 will be included in Reach 2 or Reach 3.

The 55th Street/Dry Creek Ditch #2 FIS Profile was defined as Reach #2. In the initial presentation of the matrices, a number of potential solutions were removed due to:

- Potential solution conflicts with City of Boulder Open Space
- Potential solution conflicts with known habitat conservation area of endangered species habitat
- Potential solution has past public opposition
- Potential solution has right of way constraints
- Channel or structure does not exist

For the public meeting, a designation "N/A" will be added to each alternative solution that is not applicable for a given identified problem area.

During the discussion of feasible alternatives, it was determined that the project team will not look into improvements for the 2- and 5-year events but will include consideration of improvements for the 500-year event. Some critical facilities will require protection up to the 500-year event.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

The following is a list of conclusions from the Alternatives Development workshop for Reach 2:

- The Routine Maintenance of Existing Configuration Alternative will be used as the baseline to compare to all other alternatives and cannot be eliminated from consideration.
- Acquisition of flood prone properties will only be considered for properties within the high hazard zone. Industrial and commercial properties will not be considered for acquisition of flood prone properties.
- The only practical locations for major detention facilities are upstream of US-36 or on the school grounds.
- The Lined Flood Channels Alternative will be combined with the Existing Channel Improvements Alternative. It was also determined that lining flood channels would have significant public opposition and significant environmental impacts.
- It is not practical to realign the channel for most locations within this reach.
- It was not determined who would pay for flood proofing. Would flood proofing be paid for by the City or private owners?
- Improvements upstream of South Boulder Road will be limited by the presence of Threatened and Endangered Species (Orchid and Preble's Mouse). Raising South Boulder Road to store more water was discussed as a possible alternative because excavation behind South Boulder Road would not be possible due to the presence of T&E species.
- Between US-36 and Baseline Road, there are potential Easement and Right-of-Way issues.
- There are possible Right-of-Way constraints between Baseline Road and the Wellman Ditch.

It was determined that the natural state of the area upstream of US Highway 36 floods during storm events. To provide additional storage in this location, the storage would have to mimic the current depth/duration/frequency, etc. of flooding. For open space designated as high quality, further research must be conducted to determine the possibility of constructing a large detention facility.

Possible alternatives for Reach 3 were not discussed during the workshop.

### Next Steeps

Schedule:

- A standing meeting will be set up for every other Wednesday at 10:30 AM. Alan Turner and Kurt Bauer will also coordinate via phone call as necessary.
- The initial public meeting will be held within the next month.
- Draft Alternative Plans/Recommendations - complete by August/September 2009
- Engage stakeholders when the alternatives are a more developed than they currently are
- USACE Reconnaissance Study is complete, ready to move forward with Feasibility Study
- CDOT improvements to US Highway 36 are not in the near future (possibly 2035)
- RTD Plans will not be a constraint on the recommended plan


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



### Initial Public Involvement Meeting

The public meeting will include a more detailed agenda broken down by reach with refined alternatives matrices. The public meeting may be set up as a 30 minute detailed presentation followed by an open house session. The alternatives development process will be explained to the public at this meeting and the public will be asked if there are additional problem areas within the study area that the project team should consider.

### Action Items

- CH2M HILL will provide the project team with the Technical Memorandum produced by HDR that addresses the flood threat from a lower basin storm.
- CH2M HILL will revise the screening matrices for the two reaches within the West Valley.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# South Boulder Creek Flood Mitigation Study Conceptual Alternative Plan Identification Meeting Notes

ATTENDEES:
Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Don D'Amico/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Jeffrey Lipton/CU-Boulder
Chuck Howe/Boulder Water Resources Ad. Board
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: Aaron Cook

DATE: March 17, 2010

PROJECT NUMBER: 400168

## Introduction

CH2M HILL and Alan Taylor have been looking over the possible alternative elements and alternative elements. The goal of this meeting is to eliminate some of the alternatives and end up with few alternative alignments with elements.

Every improvement recommended in a given alternative plan will have ramifications downstream. For example, if a culvert capable of conveying the 100-year regulatory flow is installed, the storage upstream will be removed, and the peak flow will increase downstream. The alternatives are in a preliminary stage right now and details such as impacts downstream will be evaluated for only the best alternative plans.

## Public Meeting Review

Everyone in attendance agreed that the public meeting went well. The community impacted by the West Valley flooding was in attendance. The community was interested in the impacts to their houses and gave a few recommendations. A number of people in attendance at the public meeting suggested that open space be used for flood mitigation.

## Schedule

The project is on schedule. Although the kickoff meeting was a few weeks behind schedule, the Conceptual Alternative Plan Identification Workshop was originally schedule for March 17 so the project team has made up time. The next workshop, to evaluate the best alternative plans, is schedule for the end of April.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Development of Screening Elements

The Alternative Element Matrix was updated to include specific options rather than a dot to show which alternatives are feasible. A narrative summary was also provided. The main categories of improvements are storage and conveyance (pipes or channels).

Upstream of US-36, the options include a levee to direct flows to South Boulder Creek and storage. Storage directly upstream of US-36 would be off-line detention while any other storage location would probably be on-line storage with a large embankment and a large spillway to convey the probable maximum flood. Approximately 2,000 – 3,000 acre feet of storage would be needed for an on-line detention pond. The Town of Boulder would like an alternative for storage upstream of US-36 that does not impact the CU South Campus property. One alternative to not impact the CU property is to have a smaller detention pond upstream of US-36 combined with increased flows through the South Boulder Creek/US-36 Bridge. The US-36 Bridge over South Boulder Creek can convey the 100-year regulatory flow. Storage upstream of US-36 alone does not fix all the West Valley flooding issue but is one key element. Other improvements upstream of US-36 could include improvements to the Viele Channel and the New Anderson Ditch.

From US-36 to Baseline Road, alternatives include storage upstream of South Boulder Road, additional storage in Baseline Reservoir, improved conveyance of Dry Creek Ditch No. 2, diversions to open space, and storage at Manhattan Middle School or the Baseline Road/ Foothills Parkway Intersection. The approximate available storage at Manhattan Middle School is 35 acre-feet, not nearly enough for the 100-year regulatory peak flows.

From Baseline Road to Arapahoe Avenue, alternatives include a pipeline along Foothills Parkway, a new conveyance through the neighborhood, storage at the golf course, and conveyance improvements to the Wellman Canal and Dry Creek Ditch No. 2.

North of Arapahoe Avenue is the location of much of the damages. Possible alternatives North of Arapahoe Avenue include a new conveyance behind buildings and a splitting some of the flow to South Boulder Creek.

Bob Harburg from the City of Boulder would like to conclude that the only reasonable solution is off-line storage upstream of US-36 but the project team concluded that we should instead eliminate the options of a large pipeline from US-36 to the confluence with Boulder Creek.

According to Don D'Amico, not all open space is equal. Above Baseline road along South Boulder Creek is high quality open space which is valuable to the City. Below Arapahoe Avenue along South Boulder Creek, the open space is not as valuable to the City. Don also reiterated that excavation in open space is unlikely.

## Hydrology

The 10-year regulatory hydrology for the West Valley is being used because there is no 10-year hydrology for the lower storm center analysis and the stormwater master plan only evaluated the 2- and 5-year events. The regulatory hydrology will also be used for the 100-year event for alternatives with and without storage upstream of US-36. For alternatives with storage upstream of US-36, the lower storm center analysis with a peak flow of 1100 cfs will also be considered.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

### Costs of Screening Elements

A spreadsheet with alternative elements for the 100-year regulatory, 100-year cutoff, and 10-year events was provided to those in attendance. The project total on the spreadsheet includes 5% for Mobilization, 5% for Stormwater Management/Erosion Control, 15% for Engineering, 1% for Legal/Administrative, 5% for Contract Admin/Construction Management, and 50% for Contingency. Unit costs were taken from the Urban Drainage and Flood Control District (UDFCD) Master Planning Cost Estimate spreadsheet. The costs provided help to compare alternatives and individual elements to determine the most cost effective alternative. Open channels are based on a flow rate per linear foot.

### Screening Level Benefits

Spreadsheets showing the average annual benefit and justifiable capital investment for four reaches within the project area were presented at the meeting. For each reach, a damage ($) versus flow rate (cfs) was created as the baseline and offset for 10-year and 100-year improvements. From the damage versus flow rate curve, a damage ($) versus probability curve was created for the 10- and 100-year improvements and average annual damage, average annual benefit, and justifiable capital investment was determined for each reach. A capital cost factor of 7% for 50 years was used in this analysis. This process will be used to determine which alternative provides the best benefit to cost ratio.

During the meeting, it was brought up that City Council will evaluate other factors besides benefit to cost ratio. Council will evaluate the types of buildings flooded, life safety, or may only look at the high hazard zone.

### Discussion of Possible Alternative Plans

The following items will be considered during the alternatives evaluation:

- **Off-line detention upstream of US-36 -** The off-line detention upstream of US-36 could have the capacity to store the theoretical maximum storage (~1100 acre-feet), could match the existing storage capacity (~300 acre-feet), or could be have a storage capacity in between the existing and theoretical maximum storage. If the CU property becomes part of the detention pond, Jeff Lipton from CU would like to use the storage areas for other uses such as playing fields.
- **Drain detention under US-36 using New Anderson and Viele -** Push water through the New Anderson and Viele crossings of US-36 to the open space between US-36 and South Boulder Road and eventually back to South Boulder Creek.
- **Extend CU berm (combined storage/levee option)** - The alternative would not provide the necessary storage upstream of US-36 but would act as a levee in forcing more water through the US-36 bridge at South Boulder Creek. A large embankment would not work according to open space requirements but this options will be evaluated further. With this alternative, the project team will need to evaluate the increased hazard downstream as a result of forcing more water back to South Boulder Creek.
- **High Hazard Alternative -** One alternative will include only those improvements necessary to remove buildings from the high hazard zone.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




- **Local detention in West Valley -** The project team will continue to evaluate local detention in the West Valley
- **Diversion to South Boulder Creek –** The project team will continue to evaluate diversions to South Boulder Creek and diversion to Bear Canyon Creek.
- **Gaptor Road –** The City may annex this area with regulations concerning the types of improvements which can be made to South Boulder Creek. Possible alternatives for improvements include improved/enlarged channel or an overflow channel. It was noted that this area is within the high quality open space area.
- **Improvements to Baseline Road –** One possible alternative is to increase the capacity through Baseline Road and spreading out the flow downstream of Baseline Road.
- **Concrete channel –** Probably not a viable option but will still be considered.
- **Grass-lined channel –** Grass-lined channels would be much wider than concrete lined channels and would come with increased Right-of-Way costs and possibility of needing to purchase residential properties. The City is willing to purchase portions of properties but not an entire residential property unless it is within the high hazard zone.
- **Underground pipes –** Underground pipes will still be considered unless the costs become too expensive.
- **Diversion to Baseline Reservoir –** Baseline Reservoir is owned by Lafayette but it is believed that there is additional storage available. The diversion to Baseline Reservoir may not be formalized but may be a consequence of forcing more water to South Boulder Creek.
- **Diversion to Leggett Reservoir –** Legget Reservoir doesn't have much additional capacity. This alternative will not be removed at this time.
- **Conveyance to Boulder Creek via Bear Canyon Creek –** This alternative will be evaluated but includes trans-basin flows which may alert the Colorado Water Conservation Board (CWCB).
- **Improvements to Ditches –** Improvements to ditches will be considered but any improvement must be approved by the ditch companies.
- **Improvements at Arapahoe Avenue –** Improvements at Arapahoe Avenue will include mitigation of commercial properties. Any improvement at Arapahoe will include collecting the flow and moving it to South Boulder Creek and Dry Creek Ditch No. 2 which are believed to have enough capacity.

### Next Steps

- The City of Boulder will provide CH2M HILL with a land acquisition cost.
- CH2M HILL will finalize a Technical Memorandum regarding the hydrology in the West Valley.
- CH2M HILL and Alan Taylor will assemble possible alternatives.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

- The project team will schedule a meeting with Jeff Lipton to discuss the CU south property.
- The project team will schedule a meeting with Don D'Amico to discuss open space uses once some alternative plans have been created.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# South Boulder Creek Flood Mitigation Study Workshop #3 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Shea Thomas/UDFCD
Chuck Howe/Boulder Water Resources Ad. Board
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: CH2M Hill

DATE: May 11, 2010

PROJECT NUMBER: 400168

## Review Progress to Date

Mark Glidden from CH2M Hill presented a brief overview of the progress to date. Work to date includes identification of the sources of the problems, development of a suite of potential solutions, development of alternative plans, determination of design discharge, alignment refinement, cost determination, and benefit estimation.

See the Workshop No 3 Review Packet for a complete summary of progress to date.

## Recommended Best Alternative Plans

### High Hazard/Critical Facilities Protection

The High Hazard and Critical Facilities Protection alternative includes flood proofing of all critical facilities within the West Valley and re-grading two properties to remove two structures from the high hazard zone. The two structures in the high hazard zone are located at the location where flow overtops US 36 into the West Valley, west of Foothills Parkway. The project team evaluated using conveyance improvements and purchasing the two structures to remove them from the high hazard zone but re-grading the properties was the least costly alternative. Critical facilities include schools, senior housing, and any building with hazardous materials. The majority of the critical facilities in the West Valley are located north of Arapahoe Avenue.

No structures along Gaptor Road will be flood proofed or removed from the high hazard zone because Gaptor Road is not included in the study area or scope of work. The majority of the residents along Gaptor Road are going to be annexed into the City of Boulder but do not want improvements to the South Boulder Creek mainstem adjacent to their properties. The residents of Gaptor Road are aware of the risks associated with South Boulder Creek flooding and do not want any changes made.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




The cost of the High Hazard/ Critical Facilities Protection alternative is approximately $10,682,000 but does not include any costs for non-structural improvements such as a flood warning system.

### CU Storage with Local West Valley Improvements

The detention pond located directly south of US 36 is located partially on CU property and partially on City of Boulder open space. The pond is approximately 750 acre-ft and prevents overtopping of US 36 into the West Valley. Without any grading to the pond area, the surface area of the pond is approximately 115 acres. A berm approximately 8 feet high is required constructed along the west and north edges of the pond to make this detention pond configuration work.

The pond must be 750 acre-ft due to the timing of the hydrology and the dead storage at US 36. In the regulatory MIKE FLOOD model, 300 acre-ft overtops US 36 into the West Valley, so 300 acre-ft, in addition to the dead storage at US 36, must be stored. The 750 acre-ft also represents the existing conditions without adding or removing any culverts through US 36. If all of the flow is forced back into the South Boulder Creek mainstem bridge at US 36, a total of 1150 acre-ft of storage is required to prevent overtopping of US 36. . If an additional 6′ x 4′ concrete box culvert (CBC) is placed adjacent to the existing 6′ x 4′ CBC at Dry Creek Ditch No. 2, a total of 300 acre-ft of storage is required to prevent overtopping of US 36.

The project team discussed the possibility of this detention pond configuration with Jeff Lipton from CU. Jeff Lipton suggested that excavation and a tiered approach be used to reduce the surface area of the pond and reduce the impact to the CU property. CH2M Hill will look into re-grading the detention pond to include excavation of the CU property. Re-grading the detention pond will allow CU the same building footprint as what is shown in their Master Plan for this property. The Master Plan currently shows 82 acres dedicated to flood storage. The downside to re-grading the detention pond to include excavation is that the pond at Table Mesa does not have a lot of capacity and flow reaching this pond will quickly overtop US 36. Representatives from the City of Boulder will be in contact with CU to determine what concessions will be required in exchange for this detention pond.

The local West Valley Improvements will be common among many of the alternatives in which overtopping of US 36 is prevented. The best alternative for local improvements in the West Valley is improving the Dry Creek Ditch No. 2 alignment with local storage. The diversion to Bear Canyon Creek and the diversion down the West Valley profile were much more costly alternatives, due to extra pipe costs, and were removed from consideration. The first element is a 48″ RCP to collect local inflows from US 36 to Baseline Road, west of Foothills Parkway followed by 9 acre-ft detention pond at the Baseline Road – Foothills Parkway Intersection. The 9 acre-ft detention pond reduces the peak flow from 150 cfs to 50 cfs and eliminates the need to modify the existing concrete lined channel parallel to Baseline Road which has a capacity of approximately 50 cfs.

Along Dry Creek Ditch No. 2, a 78″ RCP from South Boulder Road to Illini Way and an upsized open channel from Illini Way to Tenino Avenue are required to convey flows in Dry Creek Ditch No. 2. Improvements along Dry Creek Ditch No. 2 from South Boulder Road to Tenino Ave are not recommended as part of the City of Boulder Stormwater Master Plan. The local West Valley Improvements also include a 25 acre-ft detention pond at


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

Manhattan Middle School. The detention pond at Manhattan Middle School discharges to the existing 48″ RCP at along Dry Creek Ditch No. 2 and eliminates the need to upsize that pipe. With the two detention ponds upstream of Baseline Road, no improvements are required along Dry Creek Ditch No. 2 from Baseline Road to Arapahoe Avenue.

At Arapahoe Avenue, a 58 acre-ft detention pond/collection system is recommended to collect and store flows from along Dry Creek Ditch No. 2 and flows spilling across Flatirons Golf Course from South Boulder Creek. To create the storage at Arapahoe Avenue, a 3′ barrier will be constructed along Arapahoe Avenue to separate vehicle traffic from bike traffic while also providing additional storage capacity. The outlet to the detention pond is a 12′ x 10′ CBC to an existing channel downstream of Arapahoe Avenue. The CBC also serves as a bike crossing. Currently, the City of Boulder Parks Department is updating the Master Plan for the Flatirons Golf Course and are on board with this improvement. This detention pond is included in all alternatives because each alternative has a need to collect flows at Arapahoe Avenue and it removes structures below Arapahoe Avenue from the floodplain, providing a large damage reduction, and protects critical facilities.

A drainage easement must be purchased for the existing open channel directly downstream of Arapahoe Avenue but no other improvements are necessary downstream.

Improvements to the Wellman Canal are recommended for all alternatives. These improvements allow the Wellman Canal to convey the decreed flows. A 36″ RCP is recommended along the Wellman Canal through Foothills Parkway to prevent additional flows from Bear Canyon Creek to be conveyed through the Wellman Canal during flooding events.

The total cost for this alternative is $30,058,000 although the costs of the concessions to CU are unknown at this point.

### Storage South of CU with Local West Valley Improvements

The detention pond south of CU is located entirely on City of Boulder Open Space. The detention pond is 400 acre-ft and has large outlet pipes so that low flows are conveyed through the pond and only the peak flows are stored within the pond. This pond has to be greater than the 300 acre-ft that overtop US 36 into the West Valley because it is located higher in the watershed.

Kurt Bauer and Annie Noble met with Don D'Amico from City of Boulder Open Space to discuss this detention pond alternative. Don said that no excavation can occur and that a berm cannot be constructed on this site. The site is a wetland mitigation site and is being purchased by CDOT. During the meeting, Don suggested an alternative detention site located adjacent to Marshall Road. The site adjacent to Marshall Road is not on City of Boulder Open Space but is a smaller site than the open space site. There would be no limits to excavation or building a berm on this site although the site would have to be purchased.

If this alternative continues forward, wetlands can be incorporated into the detention pond. Representatives from the City of Boulder are planning on meeting with Don again next week and will report to the rest of the project team.

The local improvements in the West Valley are the same as the improvements recommended in the CU storage plan. The total cost for this alternative is $28,220,000. The


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




total cost assumes the cost to purchase the open space land to construct a detention pond is $36,000 per acre as was given in the Urban Drainage and Flood Control District Master Planning cost estimating spreadsheet.

### Mainstem Flow Containment with Local West Valley Improvements

This alternative forces all flow above US 36 back to the South Boulder Creek mainstem by making improvements to the CU levee and extending the levee along US 36. It is likely that this levee will become a jurisdictional levee due to the height, volume stored upstream of the levee, or surface area of the storage upstream. From a comparison of the regulatory MIKE FLOOD model and the levee MIKE FLOOD model, the levee forces approximately an additional 200 acre-ft of volume and an increase in peak flow of approximately 500 cfs to the mainstem. Without any improvements along the mainstem, the levee increases the depth of flow along the mainstem by less than 0.5 meters in most locations.

Other improvements along the South Boulder Creek mainstem are also required to mitigate the additional flow that is being forced to the mainstem. The first improvement is additional storage in Baseline Reservoir. It is unknown at this time what the additional capacity of the reservoir is, the price of storage in the reservoir, or what other concessions would have to be made to store stormwater flows in the reservoir. For comparison, Pine Brook Hills paid $50,000 per acre-ft of permanent storage. The other improvement recommended along the mainstem is 2 – 8′ x 5′ CBCs through Baseline Road to allow some of the water ponding behind Baseline Road into open space land downstream of Baseline Road, reducing the flow in the mainstem.

The improvements in the West Valley are the same as those recommended in the detention alternatives with one exception. The detention pond at Arapahoe Avenue would need a secondary outlet, an 8′ x 8′ CBC with a new open channel back to South Boulder Creek. This secondary outlet is required because, unlike the detention alternatives where flow was being stored upstream, this alternative forces additional flow to the detention pond at Arapahoe Avenue.

This alternative was mentioned as a possible alternative at the first public meeting. According to UDFCD, levees are acceptable as long as the prevent flooding, but detention above US 36 would be better. The total cost for this alternative is likely greater than either detention option but does provide a possible alternative should the upstream detention options be eliminated due to constraints.

### No Storage above US 36, Diversion to Bear Canyon Creek

This alternative includes no detention upstream of US 36 and large pipelines in the West Valley. In the West Valley there are two primary flow paths, one to Bear Canyon Creek and the other along Dry Creek Ditch No. 2. No local detention is recommended because the cost for local detention is greater than the decrease in cost due to decreasing the pipe size with local detention in place. Both the diversion to Bear Canyon Creek and improvements to Dry Creek Ditch No. 2 are still being considered because the cost of each alternative is similar.

The first element of this alternative is a 114″ RCP extending from US 36 to Baseline Road, west of Foothills Parkway. The 114″ RCP crossing the Foothills Parkway – Baseline Road intersection and continues parallel to Foothills Parkway to Bear Canyon Creek.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

An 8′ x 5′ CBC is required along the New Anderson Ditch to prevent overtopping into the West Valley and Dry Creek Ditch No. 2. Along Dry Creek Ditch No. 2, all pipes must be upsized to 90″ RCPs, and open channels must have their capacity increased to convey the 100-year regulatory flow. With large pipes, right-of-way constraints may become an issue. The section of open channel through the golf course will not be upgraded. This alternative also includes improvements to the Wellman Canal.

Similar to the other alternatives, detention/collection at Arapahoe Avenue must occur and the detention pond must have two outlets. The first outlet is a 12′ x 10′ CBC to an existing open channel downstream of Arapahoe Avenue and the second, an 8′ x 8′ CBC, to a new open channel back to South Boulder Creek. A drainage easement must be purchased for the existing open channel downstream of Arapahoe Avenue. No other improvements are necessary downstream of Arapahoe Avenue.

The total cost for this alternative is $36,533,000, higher than the detention alternatives but a low enough number to still provide a positive benefit to cost ratio.

### No Storage above US 36, Improvements to Dry Creek Ditch No. 2

This alternative does not include any detention upstream of US 36 and conveyance in the West Valley must convey the 100-year regulatory flows. Similar to the previous alternative, this alternative does not include local detention in the West Valley. This alternative includes a 114″ RCP from US 36 to Baseline Road in the West Valley and a 132″ RCP to replace the existing concrete lined channel parallel to Baseline Road. Along Dry Creek Ditch No. 2, pipes are to be replaced with 90″ RCPs upstream of Baseline Road and with a 132″ RCP from Baseline Road to the Golf Course. There are no improvements recommended to Dry Creek Ditch No. 2 in the Golf Course.

Similar to the other alternatives, a detention pond/collection at Arapahoe Avenue is required to reduce the peak flow and collect flows. Two outlets to the pond are required. The first is a 12′ x 10′ CBC to the existing channel north of Arapahoe Avenue. The 12′ x 10′ CBC also serves as a bike crossing. The second outlet to the pond is an 8′ x 8′ CBC to a new open channel to convey flows back to South Boulder Creek. A drainage easement is required for the new open channel north of Arapahoe Avenue. This alternative also includes improvements to the Wellman Canal.

The total cost for this alternative is $36,092,000.

### No Storage above US 36, Stormwater Master Plan Improvements

This alternative does not convey the 100-year peak flows from the regulatory model but does solve the flooding issues associated with the 5-year peak flows from the City of Boulder Stormwater Master Plan. There is no detention associated with the alternative, upstream of US 36 or local detention in the West Valley.

For local inflows, a 48″ RCP is recommended from US 36 to Baseline Road in the West Valley. No improvements are necessary for the existing concrete lined channel parallel to Baseline Road or along Dry Creek Ditch No. 2 from South Boulder Road to Arapahoe Avenue. For local inflows from Baseline Road to the Wellman, a 36″ RCP is necessary along Foothills Parkway. A 36″ RCP is recommended along 55th Street from approximately Tenino Avenue to Baseline Road and another 36″ RCP is recommended west of 55th Street


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




connecting to the Wellman Canal. Downstream of Arapahoe Avenue, a 48″ x 30″ RCP is needed along Dry Creek Ditch No. 2 to the railroad and a 54″ x 36″ RCP is needed from Arapahoe Avenue to South Boulder Creek west of 55th Street.

The total cost for this alternative is $13,004,000.

## Damage Estimates

CH2M Hill has reproduced the damage estimates from HDR with a few modifications. It appears that HDR double counted approximately 30 properties in the West Valley so the CH2M Hill damage estimates in the West Valley are less than those produced by HDR.

The following is a summary of the HDR approach to damage estimates and the FEMA BCA.

**HDR Approach**

- Used Hazus Curves
- Depth/damage relationship
- Stepwise function
- Assessed values

**FEMA BCA**

- Possible change to Hazus Curves
- Uses curve rather than stepwise function
- Uses flow rate versus damage relationship
- Replacement values rather than assess values

Because of the difference in approach, the FEMA BCA and the approach used by HDR may lead to differing results. CH2M Hill suggests the HDR approach with a few modifications.

- Use updated Hazus Curves
- Use replacement value

The project team must speak with representatives from the State to determine if this approach will work because the State has stated previously that, in order to get grant money, the City of Boulder must use the FEMA BCA approach.

## Next Steps

- Water Resources Advisory Board Meeting – June 21, 2010
- Second Public Meeting – July, 2010
- No conference call on Wednesday, May 12, 2010

## Action Items

- CH2M Hill will run the best alternative plans in MIKE FLOOD on the 8 meter grid.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

- CH2M Hill will determine the residual floodplain for each alternative input into MIKE FLOOD using the 8 meter grid. Using the results of the residual floodplain, the damage associated with each property will be determined and a benefit to cost ratio for each alternative can be established.
- CH2M Hill will evaluate excavation at the CU detention site
- CH2M Hill will evaluate the possibility of additional storage in Baseline Reservoir
- CH2M Hill will evaluate how the stormwater master plan improvements impact critical facilities and facilities within the high hazard zone
- CH2M Hill will provide the City of Boulder with a figure for detention at Manhattan Middle School. The City of Boulder will discuss this alternative with representatives from Manhattan Middle School.
- CH2M Hill will send a copy of the PowerPoint presentation to the project team
- CH2M Hill will send a link to the FEMA BCA software
- CH2M Hill is working on sections of the report


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# South Boulder Creek Flood Mitigation Study Recommended Plan Selection Workshop Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Bob Harberg/City of Boulder
Annie Noble/City of Boulder
Don D'Amico/City of Boulder
Bob Crifasi/Dry Creek Ditch #2
Shea Thomas/UDFCD
Jeffrey Lipton/CU-Boulder
Chuck Howe/Boulder Water Resources Ad. Board
Christina Martinez/CWCB
Steve Griffin/CDOT
Bob Hayes/CDOT
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Alan Taylor/Alan Taylor Consulting

FROM: CH2M HILL

DATE: August 11, 2010

PROJECT NUMBER: 400168

## Action Items

- Kurt Bauer will contact property owners impacted by the South of CU Detention Alternative.
- Kurt Bauer and Alan Turner will meet with Bob Crifasi on August 12, 2010 to discuss impacts to Dry Creek Ditch #2.
- CH2M HILL will coordinate with Danielle Yearsley/CH2M HILL about the improvements to US 36.
- For each alternative, CH2M HILL will evaluate the impact to critical facilities.
- CH2M HILL will prepare an outline/shell of the public meeting PowerPoint presentation and send to the project team for review prior to the public meeting.
- Christina will send the USACE document on flood proofing to the project team.

## Introduction

The goals of this workshop are to present the work done to date and the seven best alternatives, to discuss the seven best alternatives, and to come to a conclusion about the recommended plan(s). The project team and stakeholders will also discuss what will be presented to the public at the next public meeting. Chuck Howe is concerned that each alternative is mutually exclusive. The alternatives being mutually exclusive is fine for presentation to the public. It is still possible that alternatives could be combined, phased, or both.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Review of Work to Date

The project team has developed alternatives, sized elements for each alternative, and determined the cost and benefit for each alternative. The seven best alternatives are as follows:

- High Hazard/Critical Facilities Protection
- CU Detention with West Valley Improvements
- South of CU Detention with West Valley Improvements
- Mainstem Flow Containment with West Valley Improvements
- Pipeline Diversion to Bear Canyon Creek
- Dry Creek Pipeline
- Stormwater Master Plan

Each alternative was evaluated on the following criteria.

- Cost
- Average annual benefit/Present worth of project benefits
- Benefit to cost ratio
- Water Quality Impacts
- Environmental Impacts
- Social Impacts
- Other Factors

## Best Alternative Plan Discussion

### Alternative 1 – High Hazard/Critical Facilities Protection

The High Hazard/Critical Facilities Protection alternative focuses on public health and safety. There are two structure within the high hazard zone near the US 36 overtopping into the West Valley. These structures will be removed from the high hazard zone with localized grading improvements, but will not be removed from the 100-year floodplain. The goal of removing these structures from the high hazard zone is to reduce imminent danger of structural damage or potential loss of life.

The critical facilities protection portion of this alternative focuses on flood proofing all critical facilities within the study area. There are 25 critical facilities within the West Valley, most of which are commercial properties north of Arapahoe Avenue. Critical facilities include schools, facilities with at-risk populations, and facilities containing hazardous materials. The list of critical facilities was provided by the City of Boulder and only those facilities identified as critical facilities are included in this alternative.

Flood proofing can be problematic and is not always a reliable alternative. For purposes of evaluating the benefit of flood proofing, the project team should assume that flood proofing is only 50% reliable.

The City will not be paying for flood proofing of commercial critical facilities.

### Alternative 2 – CU Detention with West Valley Improvements

The CU Detention with West Valley Improvements alternative focuses on preventing the 100-year flood from overtopping US 36 with a 560 acre-ft detention pond at US 36, partially on CU property and partially on City of Boulder Open Space property. The detention pond


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

berm begins at the US 36 bridge over South Boulder Creek, continues west along US 36 and the ramp from Foothills Parkway to US 36, and wraps around the Table Mesa Pond. The maximum berm height is 18 feet near the Table Mesa Pond and the maximum berm height along US 36 is 6 feet. There are no water rights issues associated with this alternative because water is stored in the detention pond for less than 48 hours.

According to the Colorado Department of Transportation (CDOT), the Regional Transportation District (RTD) is in the process of designing a pedestrian bridge and on ramp near the Table Mesa Pond. The Environmental Impact Statement (EIS) also changes the Foothills Parkway to US 36 ramp which could impact the design of the detention pond. It was determined that the alternatives are only in the conceptual design phase and any design changes could be made at a later time.

CDOT was asked whether or not they would allow an embankment to be built adjacent to US 36 or if they would allow US 36 to function as the embankment for the pond. CDOT would probably accept an embankment adjacent to the ramp as long as it doesn't impact the EIS area and would prefer to have US 36 and the detention pond embankment separate. CDOT also suggested that a maintenance agreement would have to be agreed upon so CDOT would not be responsible for maintenance of the detention pond.

The spillway to the detention pond would be across US 36 towards open space and back to South Boulder Creek. CDOT stated that they could reinforce US 36 at the spillway location. The existing outlets along Viele Channel and the New Anderson Ditch do not have to be improved with this alternative. There is some question if the spillway can be directed back to South Boulder Creek since the existing flow path is towards the West Valley.

Don D'Amico noted that some of the embankment is still on City of Boulder Open Space property and in a natural area with endangered species. The project team noted that the detention pond may provide a more reliable habitat for wetland species. Don stated that detention is typically to infrequent to provide a reliable source of water for wetland species and wetland species are already present meaning there is already a reliable source of water in this area.

### West Valley Improvements

The West Valley improvements are common among the detention and mainstem flow containment alternatives. The West Valley Improvements include a 9 acre-ft detention pond at the Foothills Parkway and Baseline Road intersection with improvements (raise downstream concrete wall by 1 – 2′) to the channel parallel to Baseline Road to prevent overtopping.

Also included in this alternative are 8′ x 6′ concrete box culverts at four road crossings along the New Anderson Ditch parallel to South Boulder Road. Additional storage in the US 36 gore point is also recommended. This improvement does not impact Dry Creek Ditch #2.

Improvements to Dry Creek Ditch #2 include an increased ditch capacity from Illini Way to Tenino Avenue to prevent overtopping into the adjacent neighborhoods. At Tenino Avenue, all excess flows would be routed to a detention pond at Manhattan Middle School and no additional flows would be routed to Dry Creek Ditch #2 downstream of the Manhattan Middle School detention pond. Bob Crifasi, representing Dry Creek Ditch #2, stated that the ditch cannot accept additional flood flows due to liability issues. If the ditch


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




company were to allow flood flows into the ditch, they would ask for a complete waiver of liability. The project team should consider a pipeline parallel to Dry Creek Ditch #2 from Illini Way to Tenino Avenue. The ditch company has a 25′ easement along Dry Creek Ditch #2 so coordination with the ditch company would still be necessary. These same topics should be considered when recommending improvements to the New Anderson Ditch or the Wellman Canal. Both the City of Boulder and the ditch company prefer to separate drainage facilities from ditches so this alternative should include a separate facility for drainage conveyance.

The detention pond at Manhattan Middle School has a capacity of 25 acre-ft and is tiered to allow the fields to be inundated under different flows. The northeast corner of the field becomes the deepest portion of the pond. The pond outlets from the northeast corner back to Dry Creek Ditch #2. This pond eliminates the need for improvements to Dry Creek Ditch #2 downstream.

Along the Wellman Canal, a waste away structure is recommended near Foothills Parkway to allow flood flows back into Bear Canyon Creek. The Wellman Canal company does not want to reduce the capacity of the canal.

A 58 acre-ft detention pond is recommended at Flatirons Golf Course along Arapahoe Avenue. This pond has two outlets; the first is a 12′ x 10′ concrete box culvert to an existing drainage channel and the second is a 6′ x 6′ concrete box culvert in the northeast corner back to South Boulder Creek. Two pond outlets are needed because there are two low points in the pond. No other improvements are recommended downstream of Arapahoe Avenue.

The residual floodplain for the CU Detention with West Valley Improvements alternative shows that much of the damage in the West Valley is eliminated. There is still a residual floodplain north of Arapahoe Avenue but that is caused by flood flows from South Boulder Creek, not through the West Valley. Although there is still a residual floodplain, there is a significant reduction in damage due to a reduction in the depth of flooding. The benefit to cost ratio for this alternative is 2.15 which includes a lot of reduction of residential property damage.

It was suggested that the project team be better prepared to discuss the benefit/cost information at the public meeting by including slide(s) in the PowerPoint presentation. The slide(s) can discuss critical information such as the 7% discount rate over 50 years recommended by FEMA and the process by which the average annual damage for each alternative was calculated. Some of this information may be posted to the website prior to the public meeting.

### Alternative 3 – South of CU Detention with West Valley Improvements

This alternative includes a 420 acre-ft detention pond south of the CU property. The pond is a two-stage pond with upper stage being located between Marshall Road and Highway 93 and the lower stage located east of Marshall Road. The lower stage will require the purchase of three parcels, one of which is owned by CU. There is a large antenna on the parcel owned by CU making negotiations with CU for this parcel potentially difficult. All parcels contained in the detention pond are inundated in the existing 100-year flood. Other property owners impacted by this detention pond will be notified of the upcoming public meeting.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

The inflow into this detention pond is from flows overtopping Highway 93 and from South Boulder Creek overflows. The pond releases decreed flows to Dry Creek Ditch #2 and the main release from the pond is through a weir back to South Boulder Creek. According to Bob Crifasi, this pond cannot impact Dry Creek Ditch #2. The maximum berm height is 13′ with a maximum excavation of 5′. This pond was designed to minimize impacts to City of Boulder Open Space property but still impacts approximately 4 acres and a portion of the berm must be constructed on Open Space property.

According to Don D'Amico, City of Boulder Staff would not be in favor of this alternative. The parcel between Highway 93 and Marshall Road is owned by open space (approximately 10 acres) so the impact to Open Space property is actually 14 acres. There is also a conservation easement on the large parcel to be occupied by the lower pond, there would be visual impacts to the area, and there would be a disposition of open space. The US Fish and Wildlife Service is also trying to get this area designated as a Preble's Meadow Jumping Mouse habitat.

This alternative also includes improvements at the Viele Channel near US 36 to prevent overtopping of US 36 and the same West Valley improvements presented in the previous alternative. The residual floodplain is also similar to residual floodplain for the previous alternative. The benefit to cost ratio for this alternative is 2.51, higher than the previous alternative due to less land acquisition costs for the pond.

### Alternative 4 – Mainstem Flow Containment with West Valley Improvements

The goal of this alternative is to force flows to the South Boulder Creek mainstem and through the bridge at US 36. To mitigate the impacts of forcing flow back to South Boulder Creek, approximately 210 acre-ft of water would have to be stored at Baseline Reservoir. The project team discussed this alternative with representatives from Baseline Reservoir and it was concluded that this is not a viable alternative due to uncertainty about the requirements the State Engineer may impose if additional water is stored in the reservoir.

The other elements of this alternative are improvements through Baseline Road along the mainstem of South Boulder Creek and West Valley improvements similar to the detention alternatives.

### Alternative 5 – Pipeline Diversion to Bear Canyon Creek

This alternative includes a large (114") pipeline diversion from the West Valley to Bear Canyon Creek as well as pipeline additional pipelines parallel to Dry Creek Ditch #2 for flows which cannot be diverted to Bear Canyon Creek. This alternative would be considered a trans basin diversion and may cause water rights issues.

The other elements of this alternative are improvements to the Wellman Canal and a 58 acre-ft detention pond at Flatirons Golf Course similar to the West Valley improvements alternative.

The residual floodplain shows a reduction in damage through the West Valley. The residual floodplain is significantly larger at Bear Canyon Creek than the previous alternatives but does not cause an increase in damage. The residual floodplain is also larger downstream of Arapahoe Avenue because no limited water is being stored upstream. The benefit to cost ratio for this alternative is 1.25. The cost for this alternative is significantly higher than the detention alternatives due in part to significant utility relocation costs.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




### Alternative 6 – Dry Creek Pipeline

The Dry Creek Pipeline alternative forces all flows to a large pipeline parallel to Dry Creek Ditch #2. The other elements of this alternative are improvements to the Wellman Canal and a 58 acre-ft detention pond at Flatirons Golf Course similar to the West Valley improvements alternative.

The large pipeline alternative forces more flows towards the Industrial Park North of Arapahoe Avenue, increasing the depth of flooding, increasing the damage to the high value commercial properties meaning the average annual benefit for this alternative is not as great as in the Diversion to Bear Canyon Creek Alternative. The costs for this alternative are lower than in the Bear Canyon Creek Alternative because only one pipeline is constructed. The benefit to cost ratio is 1.24.

### Alternative 7 – Stormwater Master Plan

The Stormwater Master Plan includes only minor improvements to the existing stormwater infrastructure in the West Valley. This alternative has a low benefit to cost ratio (0.10) because the storm sewers are surcharged during the 100-year event and there is limited reduction in floodplain area or flooding depth. The Stormwater Master Plan alternative is designed to address nuisance flows, not large flood events.

### Discussion and Selection of Recommended Plan

The public meeting will be held on September 2, 2010. It was determined that some of the alternatives will not be presented in detail at the public meeting. The public meeting presentation and stations will focus on the two detention alternatives and the high hazard/critical facilities protection alternative. The large pipeline alternatives will not be presented in detail and there will not be a station for either pipeline alternative. The mainstem flow containment alternative will be presented but will not have a station. The stormwater master plan will not be presented.

The project team will be prepared to discuss the following issues which are expected to be brought up by the public:

- Hogan Pankost Property
- Costs/Benefits
- Ditch Company Issues
- CU Detention
- South of CU Detention

Prior to the public meeting, CH2M HILL will prepare an outline/shell of the PowerPoint presentation and send to the project team for input. It was determined that information will be posted to the website prior to the public meeting and no printouts will be brought to the meeting. Public meeting figures should include the 100-year residual floodplain.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study – Alternative Refinement Workshop #1 Notes

ATTENDEES: Kurt Bauer/City of Boulder, Shea Thomas/UDFCD, Alan Taylor/Alan Taylor Consulting, Mark Glidden/CH2M HILL, Alan Turner/CH2M HILL, Aaron Cook/CH2M HILL, Mark Taylor/Architerra

FROM: CH2M HILL

DATE: July 20, 2011

This meeting summary documents the major decision made during Workshop #1.

## Review of Alternative Refinements

### Bear Canyon Creek Pipeline Alternative

Bear Canyon Creek pipeline alternative alignment refined by Alan Taylor to avoid utility conflicts. The previous alignment followed the Stormwater Master Plan alignment. The new alignment follows Thunderbird Drive, crosses Foothills Parkway, then runs along the east side of Foothills Parkway before tying into the previous alignment. Additional excavation would be required along the east side of Foothills Parkway because of the existing noise berm but no right of way purchase is required. The new alignment eliminates all water and sewer crossings except major lines.

The alignment for the improvements along Dry Creek Ditch #2 was also refined by Alan Taylor to take advantage of existing easements. There are no existing easements between Tenino Avenue and Baseline Road along Dry Creek Ditch #2.

CH2M HILL is attempting to contact Qwest and Xcel to additional utility line information. If CH2M HILL cannot get this information from Qwest and Xcel, the City of Boulder has atlas sheets which have this information.

The inlet structure for collecting the flow overtopping US 36 was determined using the floodplain map, existing topography, aerial imagery, and Google Earth Street View. The inlet structure includes Type R inlets along Thunderbird Drive, Type R, Type 13 inlets and a lateral pipe along Pima Court, Type R inlets and a lateral pipe along Osage Drive, and Type R Inlets and a lateral pipe along Qualla Drive.

### Regional Detention at US 36

The US 36 Environmental Impact Statement (EIS) includes widening US 36 to the north. To be conservative, the berm was shifted 20 feet off the edge of payment which allows CDOT room for an extra lane or a bike path. The new grading results in some fill between the berm and the roadway.

The berm for the Regional Detention at US 36 alternative impacts less open space and critical habitat than what OSMP assumed.


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



### Distributed Regional Detention

The berm for the detention pond at US 36 for the Distributed Regional Detention alternative is lower than that for the Regional Detention at US 36 alternative. The berm is 20 feet off the edge of US 36 and 15 feet off the edge of CU property.

The Distributed Regional Detention alternative was originally modeled, in MIKE FLOOD, with on-line control structures at the bridges (US 36, South Boulder Road, and Baseline Road). The control structure at US 36 cannot be an on-line structure but must replicate the hydraulics of the on-line structure. To replicate the hydraulics of the on-line control structure, approximately 1,000 cfs must remain in the main channel with the remaining 6,000 cfs being conveyed in a lowered overbank. The lowered overbank requires approximately 4 feet of excavation. A berm extending from the US 36 bridge to the lowered overbanks keeps the flow in the main channel from interacting with the flow in the overbank. The flow in the overbank is stored in a pond with an outlet structure discharging back to the South Boulder Creek main channel upstream of US 36. This alternative increases the impacts to open space and critical habitat.

The detention pond/berm at South Boulder Road includes the following:

- Conspan Structure
- Realign Viele Channel 10 feet east
- Maintain existing Dry Creek Ditch #2
- Berm to protect homes from Viele Channel overflows
- Pipe New Anderson Ditch under berm
- Extend Viele Channel culvert through South Boulder Road
- Possible bike trail along top of berm
- Spillway points away from West Valley for flows greater than 100-year
- Berm is 10 feet of edge of pavement
- Maximum berm height is 7 feet above South Boulder Road
- Concrete wall instead of berm to separate Dry Creek Ditch #2 from Viele Channel

The detention pond/berm at Baseline Road includes the following:

- Conspan structure
- Offset of property lines to maintain access, easements, etc.
- Maximum berm height is 9 feet above Baseline Road
- Equalizing culverts to spread flow into open space and away from South Boulder Creek mainstem
- Irrigation ditches need to be reconnected (ditches in this area are return flows)


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

- Trail head to be relocated
- Trail connections to be reestablished

## Review of Conceptual Renderings

Two renderings were presented at this workshop:

- Looking southwest from the intersection of Baseline Road and Cherryvale Road (Distributed Regional Detention alternative)
- Looking south from the Table Mesa Drive overpass to University of Colorado property (Regional Detention at US 36 alternative)

Both renderings are based on grading provided by CH2M HILL to show the actual visual impacts of the berms. Neither rendering shows plantings, other than grasses, on the berms. Because of the process used in creating the renderings, if the viewpoint changes, the renderings must be redone.

## Review of Required Easements

Dry Creek Ditch #2 has a 10′ existing easement on the east side, but there are no easements between Tenino Avenue and Baseline Road. The required easement width along Dry Creek Ditch #2 can be reduced if the preferred alternative is a 72″ RCP instead of a 34 foot top width open channel.

An easement is needed downstream of Baseline Road to raise the concrete wall.

An easement is needed downstream of Arapahoe Avenue for the secondary channel from the detention pond at Arapahoe Avenue to the South Boulder Creek mainstem. This property is in plans for development. To reduce the easement cost, the open channel could become a pipe. To be conservative, the open channel will remain the preferred alternative.

## Review of Utility Conflicts

Conflicts of water, sewer, and sanitary lines were evaluated using GIS. The review of utility lines led to the adjustment of some pipeline alignments.

## South Boulder Creek Restoration Project

The OSMP project from South Boulder Road to Marshall Road along the mainstem of South Boulder Creek should no impact on this project.

## Review of Budget and Progress to Date

## Schedule

Next progress meeting – August 3, 2011

Next workshop – August 17, 2011

Presentation to WRAB – Fall 2011

Presentation to OSMP – Winter 2011


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study – Alternative Refinement Workshop #2 Notes

ATTENDEES:

Kurt Bauer/City of Boulder
Shea Thomas/UDFCD
Alan Taylor/Alan Taylor Consulting
Mark Glidden/CH2M HILL
Alan Turner/CH2M HILL
Aaron Cook/CH2M HILL
Mark Taylor/Architerra

FROM: CH2M HILL

DATE: August 17, 2011

This meeting summary documents the major decision made during Workshop #2.

## Update on Design Elements

The improvement to Dry Creek Ditch #2 between Illini Way and Tenino Avenue has been changed from a 34 foot top width open channel to a 72 inch diameter RCP. The pipeline includes a 25 foot easement which is less than the 40 foot easement required for the open channel.

The grading diversion structure for the detention pond at US 36 in the distributed regional detention alternative has been updated. The updated structure increases the impacts to open space and critical habitat but the function of the structure hasn't changed.

The berm at South Boulder Road for the distributed regional detention alternative has been revised to include a small wall between the Viele Channel and Dry Creek Ditch #2. The revised berm reduces the impacts to open space.

## Update on Open Space Memorandum

The impacts to open space and critical habitat increased for the detention pond at US 36 for the distributed regional detention alternative. The impacts to open space have increased by approximately 8 acres. The lowered overbank area could be returned to open space after construction but this area would still need to be purchased.

According to the City of Boulder's GIS layers, there are no wetlands upstream of US 36. It was determined that the City has identified wetlands in this area but they aren't included in the GIS layer.

The impacts to open space and critical habitat for the South Boulder Road berm are slightly less than what the City of Boulder Open Space and Mountain Parks has previously presented.

No changes at Baseline Road

## Update on Revised Cost Estimates

The revised cost estimates for the US 36 detention alternative and the distributed regional detention alternative increased while the cost estimate for the Bear Canyon Creek Pipeline


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




alternative remained relatively unchanged. The largest changes in the detention alternative is due to increases in the cost of the berms, easements, and wetland mitigation.

### Detention Ponds

CH2M HILL had previously used and equation based on the volume of storage to determine the total cost for the regional detention ponds. The unit costs from the UDFCD spreadsheet are based on local detention and result in costs that are too high for large detention ponds. In the refined analysis, actual quantities (earthwork, imported core material, riprap, concrete, and re-vegetation) were used to estimate the total cost of the detention ponds. As a result of the refined analysis, the total cost for each detention pond increased substantially. CH2M HILL will evaluate the assumptions used to develop the refined cost estimate for the detention pond and update the project team.

### Easements

Easements costs were based on existing zoning code and City of Boulder prices per square foot for land acquisition. A land acquisition cost of $0.83 per square foot was used for open space lands and for acquisition from CU. The detention pond on CU property does not impact any developable land.

The zoning for Manhattan Middle School is Public ($19 per square foot). In the refined cost estimate, it is assumed that the cost for land acquisition at Manhattan Middle School is $0.83 per square foot, the same as open space, because the pond area will be reconstructed the match the underlying function of the land.

An additional 12 to 13 foot easement is required along Dry Creek Ditch #2 for the 72 inch diameter RCP. The easement is substantially less than the easement required for the 34 foot top width open channel.

### Contingency

It contingency is currently set at 50%. The default for the UDFCD cost estimation spreadsheet is 25%. Because the alternatives have been evaluated in more detail, it was determined that the contingency can be reduced to 30 or 35%.

### Wetlands Mitigation

Wetlands mitigation has been included in the refined cost estimate at $100,000 per acre at an assumed 2:1 mitigation rate. The cost per acre includes purchasing the land and construction and design of the wetlands. The cost per acre is similar to the cost CH2M HILL has estimated for other projects.

### Utilities Contingency

A contingency of 32% has been added to all pipeline costs to account for utility relocation. A CH2M HILL internal cost estimating tool was used to determine the contingency for an urban area with no other information. The cost for utility relocation will be evaluated in further detail during conceptual design.

## Update on Benefits and Phasing

To determine the benefit for individual elements included in each alternative plan without running additional MIKE FLOOD models, the results of the benefit/cost analysis for each


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

alternative were manipulated to isolate the individual element. The benefits were estimated using an results adjusted to account for the fact that the 8 meter grid overtops US 36 during the 25-year event while the 4 meter grid overtops US 36 during the 100-year event.

The phasing of each alternative is based on the benefit to cost ratio, capital costs, flood control, life safety, and public interest.

For the detention alternatives, all local west valley improvements will be lumped together such that the benefits become easier to quantity. The local west valley improvements included improvements to the New Anderson Ditch, Dry Creek Ditch #2, Manhattan Middle School, the Wellman Canal, and the detention ponds at Baseline Road and Foothills Parkway.

For the Bear Canyon Creek Pipeline alternative, the lateral pipes and inlets will be included with the main pipeline and inlets along Thunderbird Drive.

## Update on Flood Proofing

### Frasier Meadows Manor

The flood proofing for Frasier Meadows Manor includes a 3 foot tall barrier wall around the perimeter. The garden level units at Frasier Meadows Manor make it impossible to flood proof at the building. With the 3 foot barrier wall, the entries/exits from Frasier Meadows Manor become problematic. Alan Taylor suggests using a floating gate that raises when there is flooding, similar to other gates used in the City of Boulder. During a flood, emergency access to Frasier Meadows Manor would be via access points on the north and west sides of the building. Alan Taylor will look into the cost of flood proofing Frasier Meadows Manor.

### Friend's School

The flood proofing for Friend's School, located at the corner of Baseline Road and 55th street, will at the building. The 100-year depth at Friend's School is approximately 1 foot, so the entire perimeter of the building would be flood proofed to a 3 foot depth. Flood proofing this facility results in no change to the floodplain.

### Gas Stations

Flood proofing of gas stations include ensuring underground structures are water tight and buoyancy resistant. Gas stations must all have automatic shutoff valves. Additional minor flood proofing around the structure itself can also be done.

## Update on Renderings

## Update on Terrain for Flood Mapping Study

## Update on Report Outline

## Schedule and Next Steps


COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




COPYRIGHT 2012 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

**This Page Intentionally Left Blank**

Appendix A-3

# Public Meeting Minutes

**This Page Intentionally Left Blank**

# South Boulder Creek Flood Mitigation Project

# Public Meeting #1 - March 3, 2010

The public meeting began at 5:30 PM and was finished at 7:45 PM. A 30-minute presentation by the project team that outlined the project, past studies and goals of the flood mitigation project started the meeting. At the conclusion of the presentation, general questions were entertained from the public and then the attendees gathered around four stations to ask questions and discuss potential problems and mitigation solutions related to specific project reaches

## General Questions and Answers

Q1. How will the changes from the mitigation project be incorporated into FEMA Floodplain Mapping?

A1. The City of Boulder, after completing a mitigation project, will revise the FEMA floodplain maps through a Letter of Map Revision (LOMR). This process is currently occurring on the Elmer's 2-Mile project.

Q2. How will the construction portion of the flood mitigation project be funded?

A2. The City of Boulder has earmarked $4 Million Dollars in 2012 for potential construction of the mitigation project. Other Sources for funding could come through the Federal Emergency Management Agency (FEMA) Grant Programs, the United States Army Corps of Engineers (USACE), and cost sharing projects with the Urban Drainage and Flood Control District (UDFCD).

Q3. How will current construction and development projects be incorporated into the flood mitigation study?

A3. As the flood mitigation project proceeds, current construction and development in the floodplain will be reviewed to ensure the mitigation solution incorporates these changes to the floodplain.

Q4. How was the initial South Boulder Creek Flood Mitigation Project Public Meeting publicized?

A4. The public meeting was advertised on the City's web site, 2,200 postcards were sent out to properties impacted by the South Boulder Creek 100-year floodplain, notices were sent to the newspaper, and an E-newsletter was sent. The project website address is **www.southbouldercreek.com**

Q5. What is the existing warning system that is in place if flooding occurred on South Boulder Creek?

A5. The City of Boulder has collaborated with UDFCD to implement a flood warning system in Boulder. This flood warning system consists of a network of rain gages, stream gages and radar systems to track rainfall, stream flow and storm events. If it





appears that South Boulder Creek would flood, flood sirens along South Boulder Creek would be sounded to evacuate residents and reverse 911 calls and text messages can be sent to warn residents.

Q6. How often are sirens tested?

A6. During April - October (flood season in Boulder) they are tested the first Monday of every month at 10:00 AM.

Q7. Have you looked at what other communities are doing to address flooding?

A7. The City is a member of UDFCD has hired a consultant and individual team members have professional project experience so the project team is aware of what is working and being adopted in other municipalities.

Q8. Have you looked at potential development and taken into consideration future development for the flood mapping and flood mitigation study?

A8. The flood mapping study was completed using future land use conditions. Boulder is almost completely built out and does not have large areas of land that can be developed. Development and redevelopment can occur in the watershed however; the hydrology for the flood mapping study took into account development and will move forward, unaltered, for the flood mitigation study. While the new floodplain has not yet been adopted, the City is already regulating to the revised 100-year floodplain. In fact, City Council has directed City Development Services to regulate to the most conservative flood elevation from either the effective FEMA study or the revised floodplain study.

Q9. Does this plan take into account Denver Water's Plan to increase the size of Gross Reservoir?

A9. The flood mapping study did consider this. However, during the hydrology study the most severe flood threat was the result of a storm centered below Gross Reservoir, so the reservoir had limited impact on the flooding on South Boulder Creek.

Q10. Are the public meeting exhibits available for the public to review?

A10. The maps and matrices are available on the project website at www.southbouldercreek.com. The presentations and other comment forms will be posted on the website shortly after the meeting.

Q11. How much cash is available for implementing the study?

A11. The City's Utility Capital Improvement Budgets has identified $4 million in 2012 to account for the study, land acquisition and design. $3 million of that total will be secured through bonds, the repayment of which is factored into the existing rate structure. Currently $1 million dollars in cash is available.

Q12. How will the selected plan construction be phased?

A12. It will depend on the selected alternative project and what makes sense physically and hydraulically.

Q13. The 100-year flood does not mean much to folks was the 1969 flood a 100-year flood?

A13. The 1969 flood was estimated to be smaller, about a 25-year flood. The 100-year flood is the flood that has a 1% chance of occurring in any given year. However, the 100-year storm can occur back to back.

Q14. What is the definition of the 100-year flood and how much rainfall that is?

A14. The 100-year storm was a six-hour storm with a peak rainfall of 3.89". (During the meeting the depth of this storm was mistakenly reported as around 5 inches)

Q15. What causes the flooding?

A15. Rainfall across the basin overwhelms the stream system. Four major causes.

1. Rain over West Valley causes initial West Valley flooding before South Boulder Creek Floods
2. As the flood peak approaches US-36, South Boulder Creek does not have capacity to contain the flow so flood waters flow out onto the shallow floodplain
3. As the South Boulder Creek Flood peak reaches US-36, the roadway is overtopped causing significant flooding of the West Valley
4. Culverts downstream of US-36 are undersize and contribute flows to the west valley

Q16. What is the depth of the flooding?

A16. Flooding depth varies across the floodplain from 6" deep to more than 8 feet deep depending on location. Floodplain maps can be found on www.southbouldercreek.com.

Q17. What is the duration of the flooding?

A17. The storm duration is six hours and the flood will subside substantially within 12 – 24 hours.

Q18. What are the worst types of damage?

A18. The risk assessment describes in detail the damage and risk from flooding and can be found on the website at www.southbouldercreek.com.

Q19. Will the sewer systems function during a flood?

A19. It is anticipated that the sewer system will be overwhelmed during a flood.





## Comments Received on the Boards and Flip Charts

### South of US-36

1. Consider proper natural channelization of South Boulder Creek to prevent floodwaters from leaving the channel.

### US-36 to Baseline Road

1. Hogan/Pancost - City has built up and is building soccer fields above natural grade in the area. Previous development raised the natural grade as well. This raised grade is causing groundwater to rise and is flooding basements south of Manhattan Middle School.
2. Groundwater is about 1' below ground between US-36 and Baseline Road and needs to be taken into consideration.
3. Dry Creek No. 2 Ditch should be piped from South Boulder Road to the existing pipeline at Tenino Avenue to prevent flooding along the ditch.

### Baseline Road to Arapahoe Avenue

1. The Wellman Ditch has not been maintained in several years and should be maintained.
2. The Wellman Ditch should be placed in a storm sewer pipe.
3. Stormsewer should be added to Merritt Drive diverting flood flows north to Arapahoe Avenue.

### North of Arapahoe Avenue

1. South Boulder Creek should be channelized along its entire length similar to Boulder Creek to prevent flood flows from leaving the main channel, particularly at roadways.

## Comments Received on Comment Sheets and Email

### Additional Problem Areas

1. Manhattan Drive – Runoff from South Boulder Road flows out, down Manhattan Drive, and along the ditch easement. Flow overwhelms gutters along Manhattan Drive and inundates lawns and driveways. Water freezes in the wintertime with ice 4 – 6" deep in the gutter.
2. The Intersection of Kewanee Dr. and Cimarron Way floods with minor rainstorms. In the winter, melted snow does not drain away leading to a skating rink.
3. Dry Creek No. 2 Ditch should be piped from South Boulder Road to the existing pipeline at Tenino Avenue to prevent flooding along the ditch.
4. City soccer fields west of East Community Center were raised 4' in 1979 (?) and are again being raised by the City's recreation deptartment. Website does not contain any information on new soccer fields. Soccer fields are currently creating a dam by being raised.

5. Dry Creek No. 2 Ditch functions as a storm drain for Cimarron Street, Kewanee Street and part of Manhattan.
6. Iroquois and Manhattan floods and has inadequate storm drainage to handle minor storms
7. Keep high groundwater in mind when evaluating solutions
8. Look at the impact of raising soccer fields 4 – 5 feet.
9. There is an overflow identified along the berm west of Foothills Parkway. This berm is high above the ground and seems unlikely to be overtopped. This area should be reviewed.
10. How will the changes to the soccer fields including artificial turf west of the EBRC effect flood drainage to neighborhoods west of the fields. Will flood mitigation be included in the soccer fields? Is the Land going to be raised at the soccer fields?
11. How will the development of the Hogan-Pancost parcel affect storm and flood drainage due to the increased imperviousness. How will this affect the neighborhood west of the parcel?

### Additional Solutions to Carry Forward

1. Provide containment for South Boulder Road overflow entering Manhattan Drive.
2. Pipe Dry Creek Ditch No. 2 behind homes on Oneida Street to the existing culvert on Tenino Avenue.
3. Improve drainage from Kewanee Drive and Cimarron Way to drain water to Dry Creek Ditch No. 2.
4. Do not allow development of Hogan/Pancost parcel and use it as a drainage easement to drain floodwaters to the east and open space. (Between US-36 and Baseline Road)
5. Re-grade soccer fields to 1970 grades west of East Community Center to prevent ponding and water flow to Kewanee Area
6. Enlarge Dry Creek No. 2 Ditch to prevent flooding in the Kewanee area.
7. Detention south of US-36 appears to provide the biggest benefit.

### Additional Comments

1. Maps do not show names. Great Meeting
2. Good meeting but should be held in a larger hall. You are wrong in saying the newspaper was used to publicize the meeting. Do a better job of publicizing meetings because many people are interested.
3. Good Informative Meeting
4. Do not talk so fast in the presentations.





### Email Comments

1. Pipe Dry Creek Ditch No. 2 behind homes on Oneida Street to the existing culvert on Tenino Avenue.
2. Provide a direct link to the flooding animation on the South Boulder Creek Web Site
3. Most logical and cost effective alternative would be a directional levee to direct the flood back to and through the bridge under US Highway 36, together with enough flood storage above the highway to knock down the flood peak to a manageable level.

# South Boulder Creek Flood Mitigation Planning Public Meeting #2 Meeting Notes

TO: City of Boulder

FROM: CH2M HILL

MEETING DATE: September 2, 2010

## Introduction

This document summarizes the public feedback and input received at the second public meeting for the South Boulder Creek Flood Mitigation study held September 2nd, 2010. Comments and questions were organized in subtopics based on alternative or general comments or questions.

## Introductory Presentation

Kon Damas, the meeting facilitator, introduced the project team and the meeting format that was to include a short presentation, answers to general questions and breakouts into a series of stations around the room where more detailed questions related to specific alternatives could be answered.

Kurt Bauer, the City's Project Manager, gave a brief overview of the project status to date and reiterated the objective of the meeting was to solicit public input on the alternatives being presented.

Mark Glidden, the consultant Project Manager, described the approach to the technical analysis of the various alternatives starting with the alternative screening and then discussing the improvement cost estimates and benefits.

Alan Turner, the consultant Project Engineer, described each of the alternatives evaluated in anticipation of this meeting. They included:

Alternative 1 – Status Quo
This is the do nothing but actually continues the current floodplain management programs within the City.

Alternative 2 – High Hazard Mitigation and Floodproofing of Critical Facilities
This alternative has limited structural improvements but does modify grading to remove two properties in the High Hazard Zone. It also includes the floodproofing of structures designated by the City as Critical Facilities.

Alternative 3 – Regional Detention at US 36 with Downstream Improvements
This alternative provides a large regional stormwater facility immediately upstream of US 36, inundating portions of CU and open space property, to reduce the potential for overflow of US 36. Improvements are included


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




downstream within the West Valley to capture and collect tributary inflows and eliminate the 10-year floodplain from the area.

Alternative 4 – Regional Detention near Hwy 93 with Downstream Improvements
This alternative provides a large regional stormwater facility immediately downstream of Hwy 93, inundating two large privately owned parcels as well as small portions of open space property, to reduce the potential for overflow of US 36. Improvements are included downstream within the West Valley to capture and collect tributary inflows and eliminate the 10-year floodplain from the area.

Alternative 5 – Conveyance Upgrades to Bear Canyon Creek and Dry Creek no 2
This alternative includes large pipes and other conveyance infrastructure to capture and convey overflows from US 36 and carry them away from flood prone properties. Once captured and collected, a portion of the flow is diverted to the adjacent Bear Canyon Creek drainageway where existing conveyance capacity exists. Improvements are required along Dry Creek No 2 to minimize the flood potential downstream.

Alternative 6 – Conveyance Upgrades to Dry Creek no 2
This alternative includes large pipes and other conveyance infrastructure to capture and convey overflows from US 36 and carry them away from flood prone properties. Once flows are captured and collected, improvements are required along Dry Creek No 2 to minimize the flood potential downstream.

Alternative 7 – Mainstem Containment
This alternative builds infrastructure above US 36 to prevent the overflows along US 36 to the west, thereby preventing the overtopping of US 36. A diversion into Baseline Reservoir of some of the additional flood water passing under US 36 is required to mitigate the increased discharge. Conveyance improvements along the mainstem are required to provide further mitigation.

Alternative 8 – Nuisance Flooding Upgrades Only
This alternative provides a storm sewer system that addresses nuisance flows but does little to control major floods.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

Kurt Bauer then returned to review the relative cost and benefit of the various alternatives. He presented the following table (the table alternatives have been rearranged to be consistent with the presentation numbering):

| Alternative | Estimate Cost | Benefit to Cost Ratio | Pros / Cons / Issues |
|---|---|---|---|
| 1 Status Quo | $0 | 0 | • Flood risk still remains |
| 2 High Hazard and Critical Facility Protection | $10,700,000 | 2.2 | • Does not reduce floodplain limits<br>• Questions regarding reliability of floodproofing |
| 3 Regional Detention at US36 | $35,900,000 | 2.15 | • Some impacts to Open Space and habitat<br>• Requires formal agreements with several entities |
| 4 Regional Detention near Hwy 93 | $30,700,000 | 2.51 | • Requires purchase of private property<br>• Habitat issues<br>• Requires formal agreements with several entities |
| 5 Bear Canyon Creek Pipeline | $46,286,000 | 1.25 | • Significant disruption during construction |
| 6 Dry Creek No. 2 Pipeline | $45,661,000 | 1.24 | • Significant disruption during construction |
| 7 Mainstem Flow Containment | $39,245,000 | 0.6 | • State Engineers and water quality issues with Baseline Reservoir |
| 8 Nuisance Flood Improvements Only | $13,976,000 | 0.1 | • Does not substantially reduce floodplain limits |

## General Comments and Questions

- Label and number all figures and alternatives clearly.
- Figures and alternatives numbers need to track and correspond to comment sheet and handouts.
- How many homes will be lost in a 100-year and 500-year flood?
    a. 700 homes will be removed from the 100-year floodplain
- Why was the floodplain remapped?


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




- Where operation and maintenance (O&M) costs included in all cost estimates for detention basins, pipes and other facilities?
- What neighborhoods are affected by the flooding and the proposed alternatives?
- How long will construction of the alternatives take?
- Can flood insurance be bought even if you do not live in the 100 year floodplain?
    a. yes
- How deep are the flood waters throughout the West Valley?
    a. It varies by location
- In general the attendees wanted more frequent opportunities for public comment.
- Attendees at the meeting would like future email notifications on public hearings including the citizen groups that were a part of the original flood mapping study.
- Too much budget has been spent with too little public input.
- It would be helpful is benefits were shown on the maps.
- How do other proposals/alternatives affect other neighborhoods?
- What is the length of time of disruption with these plans?
- What is the flood danger in the City? Is it solely related to the high hazard zone or only 100-year flood plain?
- During the 100 year flood – because roads and buildings are built better – there is a question as to whether or not water would be going over roads based on experience.
- Why does the effective FEMA County/City floodplain map not match the floodplain shown on the new mapping?
    a. The new floodplain mapping has not yet been adopted by FEMA. This should happen around January 2011.
- Are properties being added to the 100-year revise floodplain?
- How has the floodplain changed?
    a. A large floodplain has been identified in the West Valley
- How much water is going down the streets in the West Valley Neighborhoods?
    a. Floodwaters in the West Valley are relatively shallow but widespread.
- Benefits were estimated based on flood reduction. How did you get a dollar number from the benefits?
    a. Based on quantitative result by looking at assessed values and reduced flooding
- Is the City open to additional alternatives?
- Arizona has a unique model for flood control that includes detention on individual properties.
    – Dispersed detention
    – Contains tax incentives for individual property owners to build detention
    – Can be implements over many years
- Who will ultimately make the decision as to what alternative is selected?
    a. City council
- Why was the SBC mapping study initiated?
    a. The City knew the floodplain was wrong
- When will we know what alternatives have been selected or removed from further review?
    a. The City Staff will not form an opinion on which alternative is preferred until they get public feedback.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

a. Formal agreements would be required before any alternative moved forward. These formal agreements would include but is not exhaustive:
    - Individual property owners
    - University of Colorado
    - Independent ditch companies
    - City of Boulder Park and Recreation
    - City of Boulder Open Space and Mountain Parks
    - Boulder School District

- How do we (the public) know you are using correct models?
- Does benefit/cost ratio include or recognize the future potential change in zoning, structures and types of structures that may be built as the buildings in the West Valley age?
- The new flood mapping study has significant implications to property value based on the new 100-year floodplain. In the new floodplain property owners can't make improvements or remodel which affects resale value of the homes. For residents in the West Valley this flood mapping study and flood mitigation project is not just an issue of getting flood insurance.
- How many homes are projected to be removed by each alternative?
- Private property and homes should not be taken to implement solutions.
- The South Boulder Creek website is difficult to navigate and understand. On line mapping tool does not seem to work.
- The CU levee has to be certified.
    a. CU qualifies as public entity that can certify and maintain a levee according to FEMA.
- Does CU have any liability with flooding due to the berm/levee?
- South Boulder Creek big issue. 10 years ago the City spent money looking at flood mitigation through the West Valley. This was rejected by the public. It seems like the City has let public opinion die down and are now raising the issue again.
- The 500 year flood event needs to be analyzed with each alternative.
- Why are there no costs associated with Environmental/Social impacts?
- There is no trust for City officials.
- Attendee confirmed that the 1938 Flood resulted from a storm originating downstream of Gross Reservoir and the floodplain matches stories from what his grandfather told him.
- City of Boulder Open Space has restrictions on land use and habitat limitations that can constrain what improvements can be made in these areas.
- Action items need to be posted on the web site.
- Consultants should not charge extra to analyze new alternatives presented by the public.
- How many of the plans will have a positive impact on the West Valley?
- What is the benefit to insurance companies of completing a mitigation project?
- No one at the meeting was against flood mitigation just against certain alternatives.
- The public should be considered a stakeholder.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




## Stakeholder Comments

Urban Drainage and Flood Control made a short statement that included the following points:

- UDFCD does not believe in condemnation.
- UDFCD believes flood control and open space go together to create or enhance habitat/recreation values.
- UDFCD does not like pipes; and would rather see open channels.

Dave Webster, from Boulder County Transportation, was not notified and the Boulder County commissioners were not notified. Dave Webster will update Boulder County commissioners on the content of this public meeting.

## Alternative Specific Comments

### Alternative #1 – No Action

- Attendees agreed that something should be done to minimize the flood hazard in the West Valley that does not impact private property.

### Alternative #2 – High Hazard / Critical Facilities Protection

- How many structures are in the high hazard zone?
    a. 2 structures are in the high hazard zone.
- Why is the East Boulder Recreation Center not considered a High Hazard facility considering it stores chlorine and other chemicals?
- High hazard zone is not based on a Gross Reservoir failure.
    a. Only the 100 year storm event was used in estimating the high hazard zone.
- It would be helpful to clarify what a "Life and Limb" issue is.
- What is the High Hazard Zone? How deep or fast is the water?
    a. High hazard zone definition is a product of velocity (feet per second) and depth (feet) greater than 4.

### Alternative #3 – Regional Detention at US-36

- How was the CU property valued for the cost estimates?
    a. The project used fair market values for the cost of the property
- CU has offer to donate land for flood storage in the past– why is there a cost now?
- Why can't the CU South Campus gravel pits that exist across the property be used for flood storage?
- The Wellman Canal from Bear Canyon Creek in the 1960's caused flooding through the West Valley Area. How will the Wellman Canal flooding be addressed?
    a. Improvements to avoid overflows from Bear Canyon Creek are a part of each alternative that involves conveyance improvements
- Manhattan Middle School – use lot for detention (ball fields).
- Would like to see a comparison of the number of structures damaged depending on alternative.
- CU Berm may be protecting West Valley from experience with previous floods.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

### Alternative #4 – Regional Detention near SH-93

- What happens if a property owner is not willing to sell so that an alternative can be constructed?
- Saving Marshall – 80% of attendees support saving Marshall and oppose Alternative 4.
- Property owner Gary Swanstrom has established a website, www.rescuemarshall.com and read a statement during the meeting. The following points were included in a letter provided to the City:
    - He is not a willing seller.
    - "My house is not in the floodplain". The house and related structures are not in the floodplain.
    - Would like to see the pond placed in open space.
- Mr. Swanstrom's neighbors, Pat and Jon Militzer, made the following statement and provided a copy of their comments to the City:
    - They are not willing sellers.
    - They noted photographs of the high groundwater in the area of their residence.
    - Would like to see the pond placed on open space
- There is a high water table through the Marshall area.
- City will have to augment flows with water rights if the groundwater is exposed by the Marshall pond. The City does not own the water.
- Water table high in the area of the Marshall Pond. Pond will be full of groundwater and will not be able to hold full flood detention flows.
- City doesn't own water rights to the irrigation ditches and could have a legal issue with modifying the flow in those ditches by impounding water.
- Marshall Residents and landowners only had 2 weeks' notice of the alternative and public meeting.
- Marshall Residents and landowners had inadequate notification and would like email notice in the future of all meetings.
- The City open space behind Gary Swanstrom's Property is more suitable for detention.
- Open Space behind the Swanstrom property is damaged by gravel pits and could be restored to a more beneficial function through the flood control pond.
- The pond would destroy natural features and habitat. This habitat is currently undisturbed and has been historically undisturbed and should be left in that condition.
- Why can't take 41 acres of open space be used for flood storage?
- Move detention to open space.
- Flood detention upstream on south Boulder Creek should be reviewed. This includes a dam in Eldorado Canyon, west, of Eldorado State Park.
- The Rolling Rock area should be used for detention (Open Space north of Swanstrom/Militzer Properties).
- Would the City consider Condemnation?
- Marshal residents not part of the City and do not have representation in City Council. Stay out of Marshal.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL




- Can the City condemn land outside of the City limits?
- CU South Campus should be bought and detention pond built there.
- Why not mitigate flood hazard upstream with Gross reservoir or sites upstream?
    a. Storm center and worst flood hazard are below Eldorado Canyon.
- Attendees do not believe the 2.51 Benefit/Cost ratio of alternative #4 because of high groundwater issues.
- There is distrust in the analysis and the model. Decisions are vulnerable to how the model was created. Results should be ground truthed by talking to people on ground.
- Is flood detention most effective at SH-93? Should it be lower in case a storm center moves further north in the basin?
- City should be looking at flood protection for Marshall.
- If the storm is centered differently Hwy-93 pond may not capture flood flows.

### Alternative #5 – Mainstem Flow Containment

- No comments were registered for this alternative

### Alternative #6 – Dry Creek Ditch No. 2 Pipeline Improvements

- The Southeast Boulder Neighbor Association should be involved during construction/after to understand and mitigate impacts from alternatives #6/#7 to adjacent properties.
- Try to stay within ditch easement / park property to minimize impacts to adjacent properties.
    a. Large Pipelines would replace Dry Creek Ditch No. 2.
    a. Detention would reduce pipe size diameters.
- Big pipes mean big excavation it is desirable to minimize impacts to tree and do not want to see trees taken down.
- What is percentage blockage assumed for the large pipeline alternatives? Pipelines generally will block and may provide limited flood protection due to debris.

### Alternative #7 – Large Pipeline Diversion to Bear Canyon Creek

- The Southeast Boulder Neighbor Association should be involved during construction/after to understand and mitigate impacts from alternatives #6/#7 to adjacent properties.

### Alternative #8 – Nuisance Flow Alternative

- No comments were registered for this alternative

## Breakout Sessions

The public requested that the public comment period be extended in lieu of having breakouts at the previously described stations. No breakout session was conducted although team members provided responses to individual questions posed after the meeting was adjourned.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 1 | Cathy Kowalski | 28238 Richmond Hill | 303838-2830 | ckowalsk@jeffco.k12.co.us |
| 2 | Anna Hall | 1493 Marshall rd | 303-494-4632 | annahall@rams.colostate.edu |
| 3 | Marcy Gallamore | 6491 McIntyre Ct | 303-456-6150 | gmg1974@q.com |
| 4 | MARY CRUZ | 7710 W 87th Dr #C | 303 420-3504 | |
| 5 | Sarah Rogers | 1351 Marshall | 303 250 1749 | Sarah.Rogers@colorado.edu |
| 6 | Erin Moran | 834 Marshall Rd | 720 304 8610 | maranep@yahoo.com |
| 7 | Richard Beran | | | |
| 8 | Kyle Bohnenstiehl | 1351 Marshall Rd | 720-320-7501 | kyle@NAGI.com |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 9 | Joyce Takamine | 5449 Omaha Pl Boulder 80303 | 303 554-9785 | jabira55@msn.com |
| 10 | Peter Ornstein | 556 Aztec Dr Boulder 80305 | 303-499-2310 | pno@mediaticmail.com |
| 11 | Andrea Larson | 1588 Marshall Rd Boulder 80305 | 303-494-6013 | andrealarson@q.com |
| 12 | Kelly DiNatale | 4833 VALHALLA DR BOULDER 80301 | 303-349 3668 | Kelly@dinatalewater.com |
| 13 | KAREN LEWINN | PO Box 18238 B 80308-1238 | 3 494 5854 | KLEWINN@yahoo.com |
| | | LIVE on MANHATTAN DRIVE 80303 | | |
| 14 | Beverly Seeds | 4721 McKinley Dr 80303 | 31447-0453 | bevboulder@hotmail.com |
| 15 | Charles Demarest | 1568 Marshall Rd. | 303-931-3330 | kryptoc@ix.netcom.com |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 16 | RON CRAIG | 260 CIMMARON WAY | 303-494-2147 | roncraig boulder@msn.com |
| 17 | William P.S. Breeden Jr | 30 S. Bella Cir #3017 | 303-444-3669 | |
| 18 | Jane Grotluschen | 5887 S. Vale Rd | 3-499 4510 | jbgrotluschen@hotmail.com |
| 19 20 | WILL + SARAH PITTENGER | 1524 MARSHALL RD. | 303-494-8113 | |
| 21 | Gary Myre | 3175 11th St | 3-587-8629 | myre31@msn.com |
| 22 | Ruth Nielsen representing my parents Lloyd & Mary Vickery | 127 Glen Mawr Dr. Rollinsville CO 80422 | 303-258-7337 | Paschat11@aol.com |
| | | 5445 Marshall Rd | | Ruth@Sparkmix.us |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 23 | Olivia L. Casteneda | 160 Manhattan Dr | 303-494-4695 | — |
| 24 | Gabriele Sattler | 62 Huron Ct | 303.554.6308 | |
| 25 | Jeanette Armbrustmacher | 33 So Holman Way Golden 80401 | 303-279-0418 | Own 5431 White Place |
| 26 | FERN BOWMAN | 5444 WHITE PL | 3-817-9702 | |
| 27 28 | ROBERT + LOUISA MATHIAS | 980 CRESCENT | 720-287 8162 | |
| 29 | Ed Stroud | 5215 Illini Way Boulder | 303 499 7305 | |
| 30 | Jim Broaddus | 112 Mineola Ct | 303-819-8895 | jim@jimbroaddus.com |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 31 | William Hall | 1493 Marshall Rd | 303-494-4632 | hallb@ucar.edu |
| 32 | JOHN MILITZER | 1190 MARSHALL RD | 494-8219 | MILITZER@UCAR.EDU |
| 33 | PAT " | " | " | FRIGAHOAGIE@COMCAST.NET |
| 34 | GARY SWANSTROM | 1422 MARSHALL ROAD | 303 494-7608 | gjswanstrom@netzero.net |
| 35 | Carol Hall | 1493 MARSHALL | 303 494 4632 | hallcik@hotmail.com |
| 36 | Pam Rice | 1251 Marshall Rd | 303 810 1468 | plr@indra.com |
| 37 | Diana and | | | bobdianagabe2@msn.com |
| 38 | Bob Gabrielle | 5420 Marshall Rd | 970-240-0054 | |
| 39 | JOE REA | 5501 MARSHALL RD | 303-499-5534 | — |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 40 | Kim Opler | 1498 MARSALL Rd | 303-494-1110 | Kimopler@ |
| 41 | Carly Carpenter | Boulder CO 80305 | c) 720-838-7084 | comcast.net |
| 42 | Riley Carpenter | | | |
| 43 | Scott Sober | 1303 Marshall Rd Boulder, CO 80305 | 303-817-7501 | scott@soberopa.com |
| 44 | CAROL ATKINSON | 255 CIMARRON WAY 80303 | | abwlabu@yahoo.com |
| 45 | Marjorie Maague | 3545 ARTHUR CT 80304 | | mpmaag@e.a yahoo.com |
| 46 | Judith Moore | 1527 MARSHALL RD BLDR, CO 80305 | | JudithMoore@ Colorado.edu |
| 47 | PATRICK CLOWES | 1613 MARSHALL RD. | 3.447-0147 | patrick.clowes |
| 48 | + DOREEN CLOWES | | | @gmail.com |
| | | | | |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 49<br>50 | Durocher<br>James L + Lana R | 1433 Marshall Rd<br>Boulder Co 80305 | 303<br>204 9797 | leo@<br>Colorado windowsource.com |
| 51<br>52 | Jim + Jean<br>Johnson | 130 Manhattan Dr. | 303-494-6710 | jjbridges@msn.com |
| 53 | Ed McDowell | PO Box 229<br>Boulder, Co 80306 | 303-588<br>7727 | ecmcdjr@aol.com |
| 54 | Clancy Philipsborn | 5316 Pennsylvania Ave<br>Boulder - 80303 | 3/884-8887 | clancyph@aol.com |
| 55<br>56 | Robert + Yvonne<br>Pickerwell | 1591 Marshall Rd<br>1575 Marshall Rd | 303-499-3416<br>303-499-5811 | |
| 57 | Stacy Zander | 3082 E. 143rd Pl<br>Thornton Co 80602 | 303-424-8803 | stacy_zander@juno.com |
| 58 | SARAH<br>COWEN | 1524 MARSHALL RD.<br>BOULDER, CO | 303.494.8113 | sarahecowen@<br>gmail.com<br>sarahecowen@<br>gmail.com |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 59<br>60 | DAVID + JEANNETTE<br>HILLERY | 999 MEADOW GLEN DR<br>BOULDER | 3 494 7718 | dahill999@<br>comcast.net |
| 61 | Gene Peterson | 5496 Seneca Pl<br>Boulder | 303 494-0621 | jfpeterson@juno.com |
| 62 | DAVE WEBSTER | BOULDER COUNTY<br>TRANSPORTATION DEPT<br>P.O. BOX 471<br>BOULDER, CO 80306 | | |
| 63 | Tim Jacks | 1453 Marshall Rd<br>Boulder, co 80305 | 720 308 6675 | Timjacks2@comcast.net |
| 64 | Don Chambers, AIA | 1525 Marshall Rd. | 303-554-5591 | don@chambersarchitecture.com |
| 65 | Ruth Blackmore | 705 S 41st Street<br>80305 | 3/494-3009 | ruthelb@hotmail.com |
| 66 | John Stevens | ~~[illegible]~~<br>6420 Gunpark Dr<br>Ste B<br>Boulder CO 80301 | 3 210 3333 | J.Stevens@<br>Sports Development.com |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 67 | CLARA MASSALIN | 919 ROXWOOD BLD CO | 303-499-9404 | cmassalin@hotmail.com |
| 68 | Lyle Rosbotham | 1190 ALBION BOULDER, CO 80305 | 303-554-0797 | Lyle@HIS.COM |
| 69 | Luis Martinez | 10586 W. 107th Ave Broomfield | 303-469-2488 | |
| 70 | Robert Sharpe | 5995 marshall Dr 80301 | | RSharp4802@AOL |
| 71 | Linda Gerstle | 1521 Marshall Rd 81305 | 303-494-9169 | lindagerstle@comcast.net |
| 72 | Shelley Schlender | 751 Crescent Drive | 3/494-2545 | shelleyschlender@yahoo.com |
| 73 | TIM ENE | 1506 S. FOOTHILLS HWY BOULDER, 80305 | 303-601-3654 | T-ENE@NORTHAMSOFTWARE.COM |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 74 | Loretta Hempstead | 3315 Dover Dr 80305 | 303 4949325 | llhemp2001@comcast.com |
| 75 | DON BARSHAY | 705 S. 41st St. 80305 | 303-494 3009 | |
| 76 | Jo Martinez | 10556 W 107th Ave Broom | 303 469-2488 | |
| 77 | Gordon McCurry | 1200 Albion Rd Boulder 80305 | 303-494-8771 | gmccurry@comcast.net |
| 78 | Beth Ornstein | 556 Aztec Dr | 303-499-2317 | beth@mediationnow.com |
| 79 | Mary Nelson | 4800 QUALLA DR | 303-499-0571 | Please mail notices. Thx |
| 80 | Les Nelson | " | 303-499-0571 | |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 81 | FRED CACCESE | 1065-D FAIRWAY CT BOULDER, 80303 | 3/494-9134 | fcaccese@hotmail.com |
| 82 | GLENDA LAINIS | 375 MANHATTAN DR BOULDER 80303 | 720 8873524 | aglainis@aol.com |
| 83 | BEN BINDER | 720 So. 41ST BOULDER 80305 | 303-499-2568 | BDINDER@DDGINC.COM |
| 84 | Jim Fulton | 4995 Ricaire Dr Boulder 80303 | 303-494-3549 | Jagfulton@aol.com |
| 85 | Chris Jessen | 4900 RICARA DR | 307-287-3546 | Cjessen88@yahoo.com |
| 86 87 | Les Botham Leonard Rice Engrs. | 2000 Clay St Denver CO 80211 | 303 455 9589 | Les.Botham@LREwater.com |
| 88 | TAYLOR FREY | 630 CREE CIR. & 5540 CENTRAL AVE | (303) 442-6995 | taylor@Flatironpark.com |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 89 90 | Ann & Bob Fink | 5432 whiteflower Boulder (Co) 80303 | (303) 494-8958 | robert_fink@colorado.edu |
| 91 | JOHN JASEK | 19328 Hill Dr. Morrison Colo | 303 697 1868 | JRJASEK@AOL.COM |
| 92 | Julie Leonard | 1534 Marshall Rd Boulder, CO 80305 | 303-499-4811 | j.a.leonard@mindspring.com |
| 93 94 | Jim & Helena Knox | 5322 Pennsyl. Boulder 80303 | 303-499-9345 | |
| 95 96 | Lynn & Sandi Scanlon | 1019 S Foothills Hwy 80305 | 303-444-0542 | scanlun1@mail.com |
| 97 98 | Priscilla Robb Larry Trilling | 1275 Marshall Rd Boulder 80305 | 303-494-2165 | ltrillin@hotmail.com priscillarobb@hotmail.com |
| 99 | Letty Perkins | 1423 Marshall Rd Bldr. 80305 | 303 499 0177 | |

South Boulder Creek Flood Mitigation Study
2nd Public Meeting Municipal Service Center
Thursday Sept. 2, 2010 5:00 – 8:30 P.M.

| | Name | Address | Phone | Email |
|---|---|---|---|---|
| 100 | Rod STRouse | 922 cottonwood Cir | 3/961-1746 | STRouseRod @yahoo.com |
| 101 | Bryce Kowalski | 4305 W Kenyon Ave | 720.934.7382 | bryce983@yahoo.com |
| 102 | Kim Sloan Thorne | 186 CARRS | 303-237-6324 | — |
| 103 | Marci Gasek | 19328 Hill Dr. | 3/697-1668 | mjasek@jeffco.k12.co.us |
| 104 | David Shomper | 3170 Kittrell | 303 494 0629 | dshomper@mac.com |
| 105 106 | Michael + Mary Craven | 1475 Marshall Rd | 720-299-9206 | mmcraven@peoplepc.com |
| 107 | Keagan Hawley | 1455 5th 74th Street | 505 153 1077 | Kzadwalley@gmail.com |

# Appendix A-4
# Stakeholder Meeting Minutes

**This Page Intentionally Left Blank**

# SBC Flood Mitigation Study – CU Meeting 5-6-10

ATTENDEES: Kurt Bauer/City of Boulder, Jeff Lipton/ University of CO, Mark Glidden/CH2M HILL, Alan Turner/CH2M HILL

FROM: CH2M HILL

DATE: May 6, 2010

The Taggert study indicated that considerable value accrues from storage in the South Boulder Creek watershed. This study has reached the same conclusion. Several different storage, size and geometries are being considered. Jeff indicated he wanted to know how much the current study proposals differ from those in the Taggert study so that he can approach his boss and the Board of Regents.

The current study looks at three different storage concepts, ranging from 300 acre feet (AF) to over 1200 AF. Each of these has some impact on the CU South Campus and may impact the use of the land for some of the identified purposes. Jeff recognized this would probably be the case. He wanted to make sure the impacts were limited and that full advantage was taken of the designated areas, including the lower pond.

Jeff described some of the basic constraints Cu would like to impose. First, they want to try and minimize the impact to the plan they formulated and presented to us at the first workshop. This describes areas they anticipate will be inundated as well as those areas they wish to preserve for development. He also described the access road and the challenges they faced when developing that alignment. They need to maintain the proposed configuration as closely as possible. There may be some potential to modify grades but not the alignment.

The team described the 750 AF alternative. This has an 18′ maximum berm height and minimizes excavation. However, it does have a pretty big impact to the identified building sites. Jeff asked if it would be possible to minimize that impact by doing some excavation and increasing the storage volume on areas not designated for development. He also expressed concerns about the extent of ponding at the current tennis court site. He encouraged the team to look at more excavation and any other means to reduce the footprint of the ponded area. He reiterated his interest in using the low area and pond to the north to the fullest extent possible. The team indicated we would look at ways to use more of the designated flooding area and reduce the impact on the sites designated for development.

Jeff did note that the fact the site has a reclamation permit means there are no designated wetlands on the site.

The team asked that Jeff provide some insights on the cost and political implications of the proposed plans. In particular, it was hoped that there would be a better understanding of the cost associated with land acquisition and any other necessary infrastructure improvements. Any other issues such as annexation or utility service needs could impact the feasibility of the alternatives and would need to be identified as early as possible.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



The team mentioned that the cost of land required by other entities was getting clearer. Parks would not require any direct payment of land used. Boulder Valley Schools would require the purchase of an easement at prevailing land rates. Open space was not likely to charge for the use of their lands but were likely to require other concessions.

The schedule was discussed. The interest in having the first presentation to WRAB on June 21 and then a public meeting in July make the determination of some of the details of the CU storage site critical. It is hoped that CU can provide feedback as soon as possible.

Jeff offered that the current alternatives that show ponding at a depth of 20′ at the tennis courts is unworkable and unacceptable. The team should look at excavation to minimize the depth and footprint of flooding in those areas designated for development.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL

# SBC Flood Mitigation Study – CU Meeting 6-24-10

ATTENDEES: Kurt Bauer/City of Boulder, Bob Harberg/ City of Boulder, Jeff Lipton/ University of CO, Mark Glidden/CH2M HILL, Alan Turner/CH2M HILL

FROM: CH2M HILL

DATE: June 24, 2010

Alan provided an overview of the current proposed pond configuration and the way the system works. (Proposed CU Detention Figure attached) The pond proposed in 520 acre feet (AF), smaller than the probable size discussed at the previous meeting. The pond volume was developed by using the natural topography and excavating to minimize the footprint. The excess excavated material is proposed as fill to elevate key areas of the CU property.

Alan also described the function of the lower pond. This pond controls the Viele channel and isn't really an element in the mainstem flooding from South Boulder Creek. The pond controls the tributary area draining along the Viele Channel and prevents that from surcharging the system and overflowing across US 36. However, the size is quickly overwhelmed if uncontrolled flow from the mainstem is allowed to reach the pond. The team concluded the lower pond needs to be isolated from uncontrolled mainstem flows. However, the timing and volume are such that the new storage pond can be drained into the Viele channel and then under US 36. Using this outfall avoids the need to construct another crossing under the highway.

Both Jeff and Bob identified that he proposed configuration should explore the expansion of the storage area to include the Table Mesa Pond by wrapping the embankment around that site. Alan would look at this to determine what the embankment configuration might look like.

Bob noted that the schedule for the project was to have the alternative evaluation done by the end of the year and then work with the City's Boards and Council to finalize the plan. He noted that the costs now are in the $30-40M range and it wasn't likely the City could come up with that kind of money in the short term. The team is looking at alternative funding sources such as the state through a Pre- Disaster Mitigation Grant or from the feds by working with the Corps of Engineers.

One key element is the cost of the land. The team is looking at costs ranging from $36k/acre to $19/SF depending on land use type. The selection of the cost has a profound effect on the viability of an alternative. Jeff suggested we look at recent open space land purchases to find a cost that could serve as a precedent.

Jeff asked if we have been coordinating with CDOT. Bob indicated that discussions have been held. During those discussions, they indicated that improvements to US 36 are very low on the list of priorities and that it may be 20 or 30 years before anything is done to the highway. There is some work ongoing related to a pedestrian overpass and other improvements outside the highway. Jeff mentioned that he was aware of some


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL



improvements to the configuration of the Table Mesa interchange. His contact is Mike Sweeney.

Jeff indicated he needed the following information before he could take the alternatives to his bosses:

- Estimate the acreage that would be undevelopable including the area within the Table Mesa pond.
- Compare the current configuration with the original plan and determine the impact on the developable footprint.
- Use the cost of recent open space acquisitions for agricultural lands as the basis for land costs that were designated as open or flood storage. Use developed costs for those areas designated for development.
- An updated version of the plan showing the impacts to the CU plan

Jeff noted that it would be desirable to be able to co-locate their detention storage within the bigger pond area. This probably would not material impact pond sizing and could be incorporated during final analysis and design. He also indicated that if grading was going to be done, it would be good if it could be done in such a way as to accommodate the future construction of recreation fields. He provided a plan with the desired recreation field layout. The team agreed to incorporate this in future modifications.

The City and CU need to figure out the terms of any development agreement or utility concessions. CU is ready to begin these negotiations. It isn't unreasonable to assume that process would lead to other issues.

The issue of groundwater levels was raised. Not only can that impact the potential effectiveness of the ponds, but exposed groundwater can have water rights implications. The team assured him that we have tried to avoid any impacts to extent data was available.

The site is still under a reclamation plan and any modifications would need the approval of the Mined Land Reclamation Board.

Jeff asked to look at the lower pond configuration again. Alan explained that we did look at the possibility of storage in the lower pond and simulated the hydraulics. The result was that a workable pond had to be about 30′ deep and might have some groundwater issues.

The team did consider a storage options above the CU property. This project includes a berm near Marshall Road that would control downstream flooding. This pond is also being revised based on feedback from Open Space. It would continue to result in some inundation of the CU property but no physical improvements would be required.

When developing costs for the CU pond, it is only necessary to consider rough grading costs in addition to land and pond infrastructure. CU would not expect any of the recreation fields to be built using these project funds.


COPYRIGHT 2010 BY CH2M HILL, INC. • COMPANY CONFIDENTIAL